ON THE COVER

BEFORE any large structure is built, engineers satisfy themselves that it will rest on stable ground. In the case of dams, the underlying material must be capable of supporting the load to be placed upon it and also be of such a character as to permit making it virtually watertight by the injection of grout. Since human eyes cannot look into the ground, samples of the subsurface are extracted by means of diamond-core drills for visual examination, strength analysis, etc. Our cover picture shows a drill barge anchored in the Colorado River on the line where Davis Dam is rising. The picture was taken in the spring of 1947.

•

IN THIS ISSUE

DAVIS DAM, the subject of our first article, will complete the U. S. Bureau of Reclamation's program for harnessing the lower reaches of the Colorado River in this country. It will control the stream flow below Hoover Dam, storing water for downstream irrigation purposes that otherwise would escape unused to the Gulf of Lower California. This will benefit water users in both the United States and Mexico and fulfill our treaty obligations with our neighbor country to the south. As it is released, the water will turn turbines to generate a sizable block of power.

•

"SOMETHING old, something new," might well be the theme song of the Quarrymaster drill, a self-contained machine for putting down large blast holes (Page 60). For the drilling element, the engineers went back to the pioneer piston-type tool because it possesses definite advantages for their purpose. The compressor, hoist, running gear, and other elements are, however, strictly modern developments. This happy combination of the technique of yesterday and today promises more efficient drilling for quarries, open-pit mines, and coal-stripping operations.

•

BY PUTTING natural gas, called our purest fuel, into the ground with petroleum, Nature provided costless pressure to lift the oil to the surface. In past decades, much of the gas was used prodigally and, having done its work, was wasted. Federal and state controls are now putting an end to this practice, and scores of plants are extracting valuable liquid hydrocarbons from the gas. The residue gas is then either piped to places where it can be beneficially used as fuel or returned to the ground under pressure so that it may lift more oil to the surface. A typical treatment plant is described (Page 63.)

Compressed Air Magazine

VOLUME 53 **March, 1948** NUMBER 3

G. W. MORRISON, *Publisher*

C. H. VIVIAN, *Editor* — J. W. YOUNG, *Director of Advertising*
ANNA M. HOFFMANN, *Associate Editor* — J. J. KATARBA, *Advertising Mgr.*
A. W. LOOMIS, *Assistant Editor* — DON J. MAREK, *Advertising Sales*
WALTER P. GILLINGHAM, *Assistant Editor*
D. Y. MARSHALL, *Europe*, 243 Upper Thames St., London, E.C.4.
F. A. MCLEAN, *Canada*, New Birks Building Montreal, Quebec.

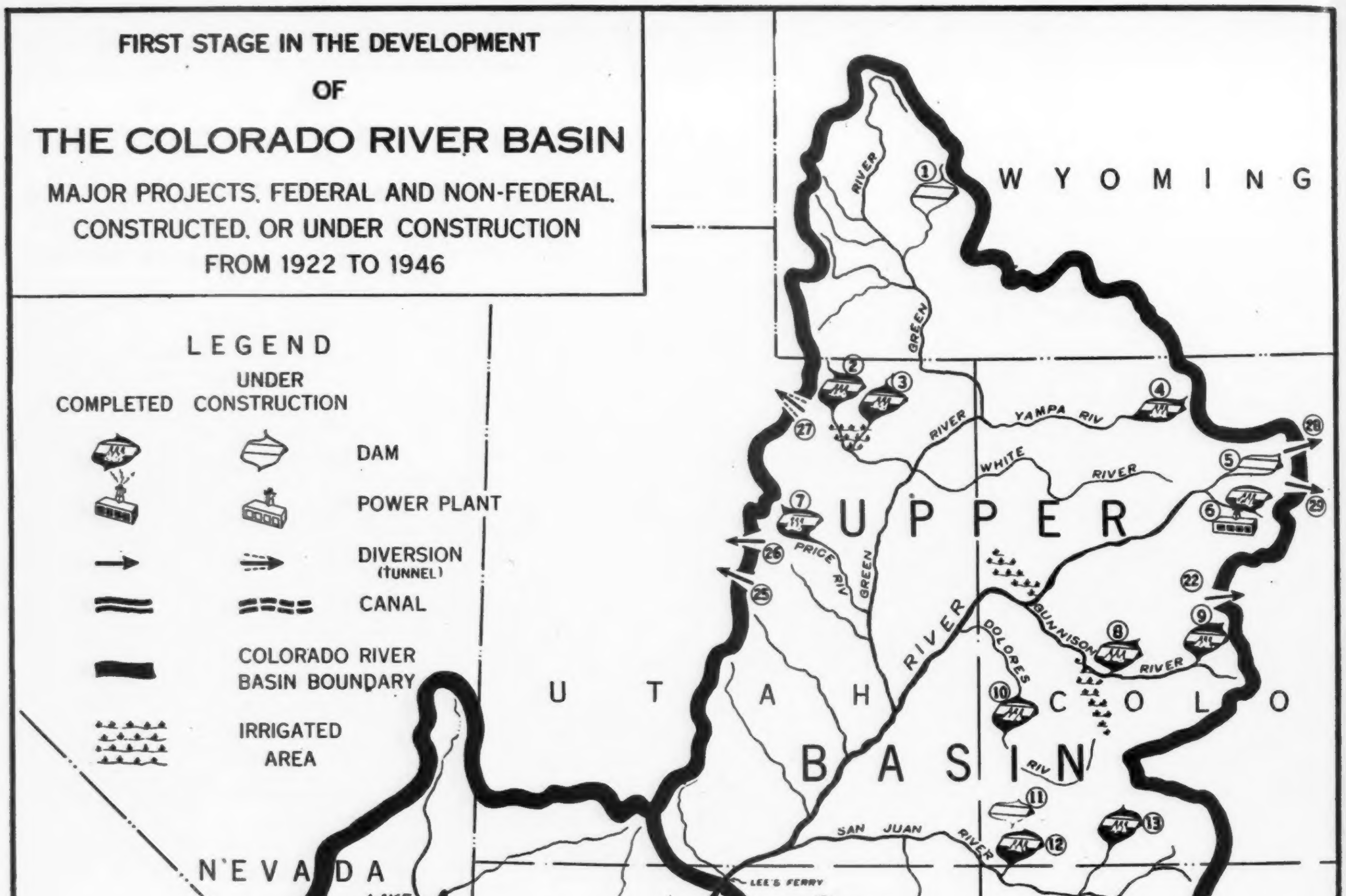
EDITORIAL CONTENTS

ADVERTISING INDEX

A monthly publication devoted to the many fields of endeavor in which compressed air serves useful purposes. Founded in 1896.

CCA Member Controlled Circulation Audit

Published by Compressed Air Magazine Co., G. W. MORRISON, *President;* C. H. VIVIAN, *Vice-President;* J. W. YOUNG, *Secretary-Treasurer.*
Business, editorial, and publication offices, Phillipsburg, N. J.
Advertising Office, 11 Broadway, New York 4, N. Y., L. H. GEYER, *Representative.*
Annual subscription: U.S., $3.00; foreign, $3.50. Single copies, 35 cents.
COMPRESSED AIR MAGAZINE is on file in many libraries and is indexed in Industrial Arts Index.



FROM RECLAMATION ERA

KEY TO NUMBERED SYMBOLS ON MAP

1. Big Sandy Dam, Wyo.
2. Midview Dam, Utah
3. Moon Lake Dam, Utah
4. Stillwater Dam, Colo.
5. Granby Dam, Colo.
6. Green Mountain Dam and Power Plant, Colo.
7. Scofield Dam, Utah
8. Fruit Growers Dam, Colo.
9. Taylor Park Dam, Colo.
10. Groundhog Dam, Colo.
11. Jackson Gulch Dam, Colo.
12. Narraguinnep Dam, Colo.
13. Vallecito Dam, Colo.
14. Hoover Dam and Power Plant, Ariz-Nev.
15. Davis Dam, Ariz-Nev.
16. Parker Dam and Power Plant, Ariz-Calif.
17. Headgate Rock Diversion Dam
18. Imperial Dam
19. Siphon Drop and Drops Nos. 3 and 4 Power Plants, Calif.
20. Horseshoe Dam, Ariz.
21. Bartlett Dam, Ariz.
22. Twin Lakes Extension Tunnel, Colo.
23. All-American Canal System, Ariz-Calif.
24. Coachella Branch, All-American Canal System, Calif.
25. Ephraim Tunnel, Utah
26. Spring City Tunnel, Utah
27. Duchesne Tunnel, Utah
28. Alva B. Adams Tunnel, Colo.
29. Moffat Tunnel, Colo.

Davis Dam

Latest Link in the Bureau of Reclamation's Plan to Regiment the Colorado River Below Hoover Dam

L. A. Luther

DRILLING ON THE BIAS

Easily maneuverable wagon drills are the mechanical workhorses on the heavy rock-drilling schedules. Illustrating the adaptability of these machines is this view of a group of FM-2 units putting down angling holes at the site of the right forebay channel wall which, when completed and surfaced with concrete, will have a 1 to 1 slope.

FISHERMEN and sight-seers in the high Rockies are familiar with the Colorado as a capricious mountain stream, and in that part of its 1400-mile course lying above Hoover Dam and Lake Mead its character has changed little. By the time the melted snow and spring waters have reached the Grand Canyon they have taken on the red-chocolate hue that gives the river its name and inspired someone to remark that it was "too thick to drink and too thin to plow." From its 244,000-square-mile watershed, the Colorado in years gone annually dredged down to its delta more solid material than was moved in building the Panama Canal, and in flood stages its flow rose to 300,000 second-feet to make it the most feared of western rivers.

At some points the delta channel was more than 100 feet above the surrounding area. In fertile Imperial Valley, lying partially below sea level, a growing host of ranchers looked upon the silted banks of the stream as being at once the source of all life and the demon continually threatening to destroy them. During the major flood of 1905-1907, more than seven million dollars was expended in fighting to hold the river in bounds, but it ran wild for nearly two years and raised the level of the Salton Sea some 73 feet until finally curbed by the Southern Pacific Company. There were then no great combinations of contractors such as Six Companies Inc., which built Hoover Dam, and only a railway system like the Southern Pacific possessed the funds, equipment, and know-how to cope with the stream when it spilled into Imperial Valley.

Davis Dam, with which this article is concerned, is being constructed in Pyramid Canyon as the last in a series of coördinated structures below Hoover Dam. These, together with the latter, include Parker, Headgate Rock, Imperial, and Laguna, all projects of the U. S. Bureau of Reclamation with the exception of Headgate Rock Dam which was planned by the Indian Service. All these structures play a part in regulating the river, storage, and diversion of the water for irrigation and domestic use in the United States and Mexico. Hoover, Parker, and Davis have an added function, that of producing hydroelectric power.

The 727-foot-high Hoover Dam, which

DAVIS DAM DATA

Location: On Colorado River, 15 miles upstream from Needles, Calif., and 67 miles downstream from Hoover Dam.

Type: Earthfill

Height: 200 feet above foundation; 130 feet above tailwater

Thickness at base: 1400 feet

Length of crest: 1600 feet

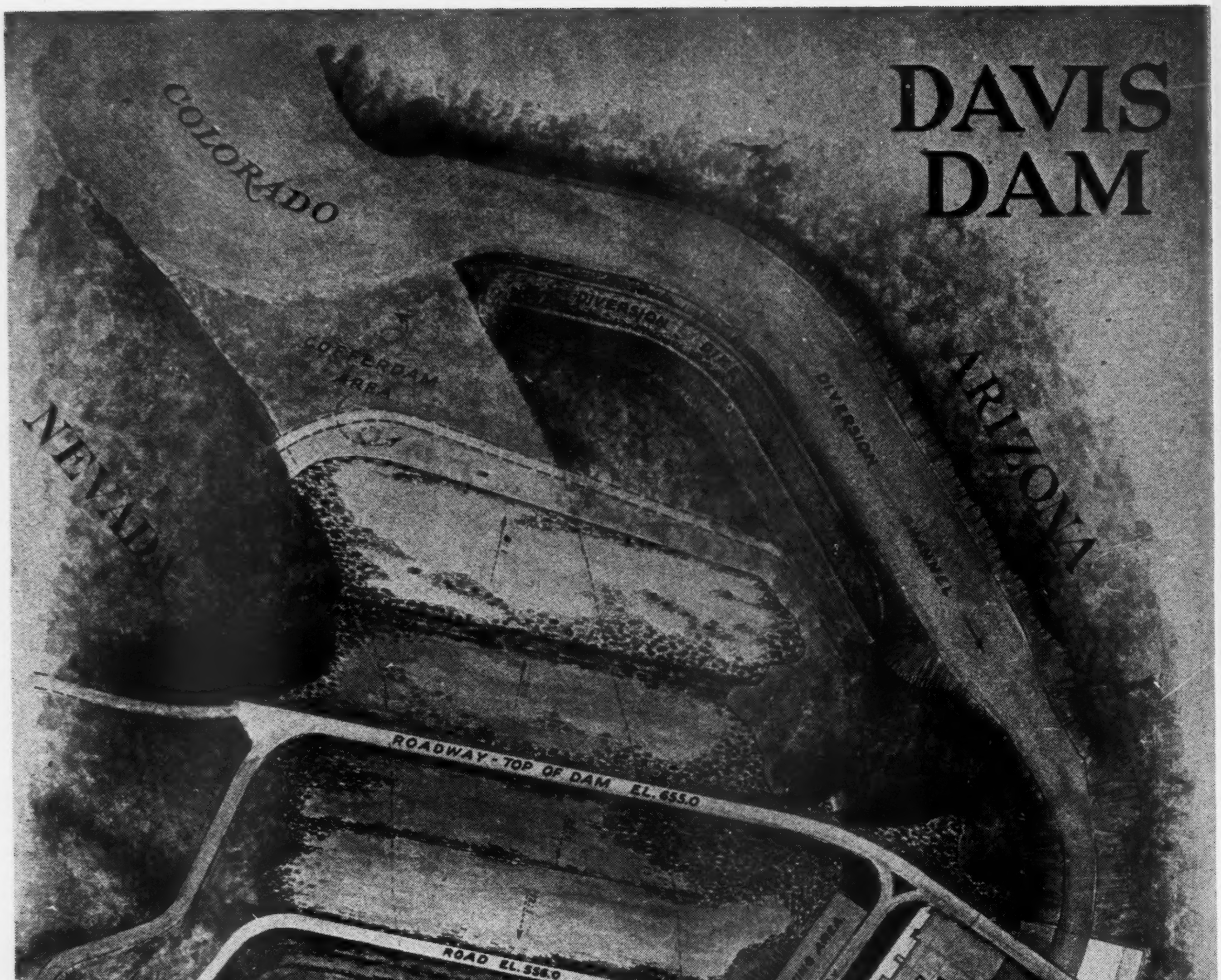
Spillway capacity: 200 second-feet

Reservoir capacity: 1,750,000 acre-feet

Power capacity: 225,000 kilowatts

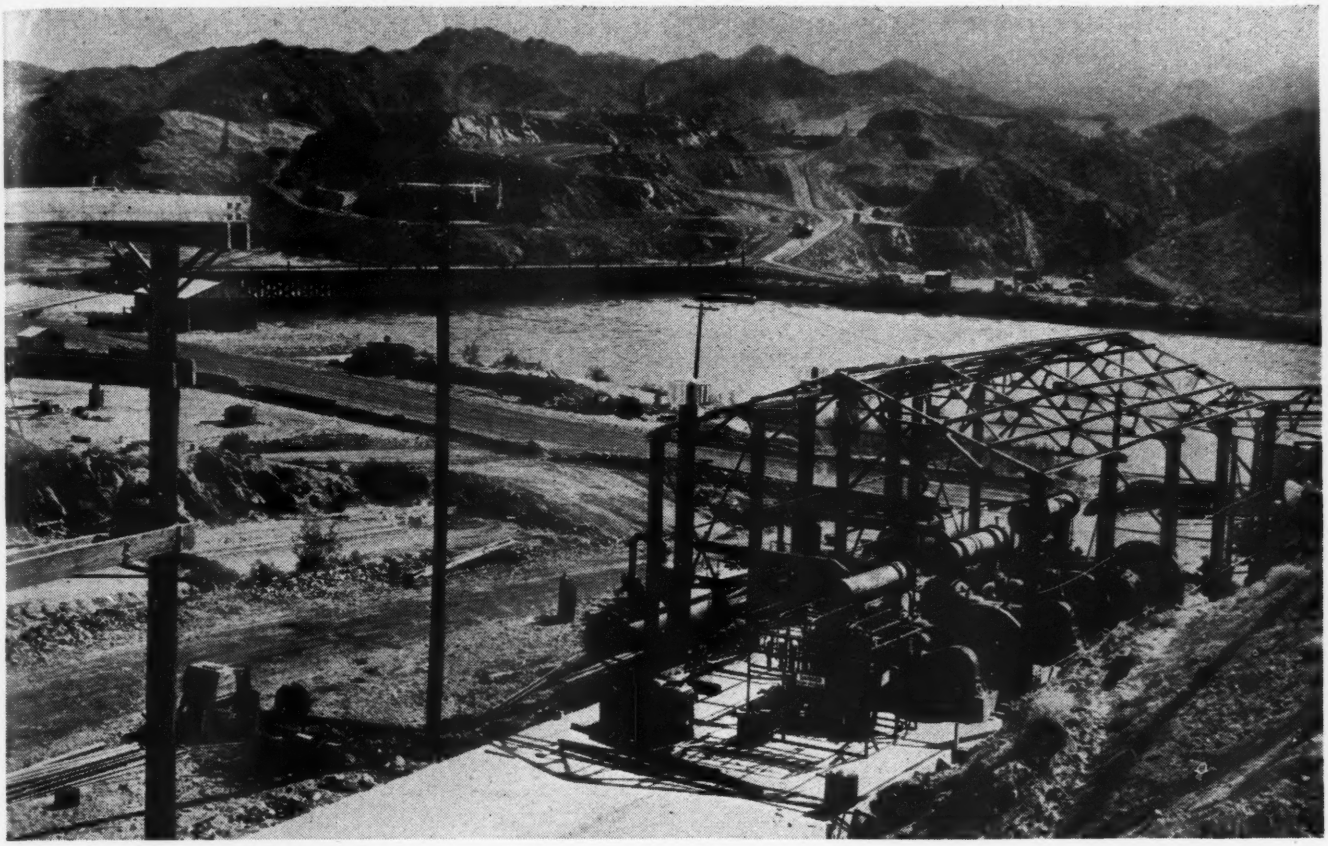
Average annual output: 900 million kilowatt-hours

Estimated cost: $104,000,000



ARTIST'S VISUALIZATION

Future air travelers will see the dam and its environs somewhat as they are portrayed here. The diversion channel, used during the construction period to by-pass the river, will later carry water to the turbines. The continuation of the dam crest line at the right will be the intake structure. Since this drawing was made, its position has been changed.



COMPRESSOR PLANT

This picture, looking across the river from the Nevada side, was taken in July, 1946. In the foreground is the compressor plant, which was in operation while the steel framework for the enclosing building was being erected. Each of the three Ingersoll-Rand machines can deliver 2200 cfm. at 100 psi. pressure. The air is piped across the trestle, left-background, to the working area on the Arizona side of the Colorado River.

is 67 miles upstream from Pyramid Canyon, is the keystone in this long-range enterprise that makes the building of the related structures in the lower Colorado practicable, if not always easy. Once the runoff from a shower or sudden thaw on any Rocky Mountain tributary has reached 115-mile-long Lake Mead—which is capable of impounding approximately 32,000,000 acre-feet, or two years' average flow of the river—it becomes a metered and regimented part of the water resources on which agriculture in southern California and southern Arizona depends. Besides, the stream supplies Los Angeles and fourteen other coastal cities with water for domestic purposes by way of the Colorado River Aqueduct, which diverts it at Parker Dam. The river now deposits most of its silt in the upper reaches of Lake Mead, and if the Spanish padres who christened the stream were to visit it today and watch it in its progress through Pyramid Canyon, its deep-green color might evoke some other descriptive Latin name.

Choice of the site for Davis Dam was determined to a great extent by the proximity to the upper end of Havasu Lake behind Parker Dam, next below it on the river, and by the fact that Davis Reservoir, which is to have a maximum width of 3 to 4 miles, will extend up to the tailraces at Hoover. Two prehistoric channels crossed at the site, which is a natural bottleneck. The canyon at this point, as some of the illustrations show, has little of the steepness characteristic of Black Canyon, where Hoover Dam is located, though the mountains on the Arizona side rise to 4000 feet in a distance of 13 miles.

Operation of Hoover Dam is governed in large measure by the demand for electric power for domestic use and by the rapidly increasing number of manufacturing enterprises in southern California. At certain periods, the water released through the penstocks at Lake Mead is in excess of current irrigating needs. The surplus escapes, unused, to the Gulf of California. The Davis Dam will permit impounding the discharge from Hoover and thus make it conform more closely to downstream requirements. Davis Dam also will help to control the flow of the Colorado in accordance with the stipulations of the Mexican Water Treaty ratified November 8, 1945. Utilizing the last substantial head in the river below Hoover Dam for the production of power, Davis will generate from 800 million to a billion kilowatt-hours annually, or about one-fifth of the output of the Hoover power plant.

Plans provide for an earth-and-rock-fill dam, together with appurtenant structures including a 225,000-kw. hydroelectric plant, and for some 900 miles of transmission lines with substations and accessories. The barrier will create a 1,750,000-acre-foot reservoir that will have a normal 645-foot surface elevation and will offer new facilities for recreation and a fish and wildlife refuge. Like the road carried across spectacular Hoover Dam, the new route across the crest of Davis will form another link in the highway system of this once remote area.

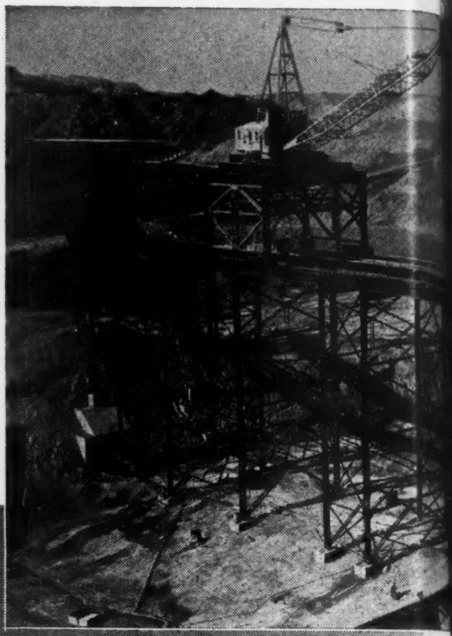
The Davis Dam Project was authorized by Concress under provisions of the Reclamation Act. It was first known as "Bull's Head" after a Pyramid Canyon rock formation, but was renamed "Davis" in 1941 after the late Arthur Powell Davis, one of the originators of the Reclamation Service. As director of the latter from 1914 to 1923, Mr. Davis initiated the planned development of the Colorado.

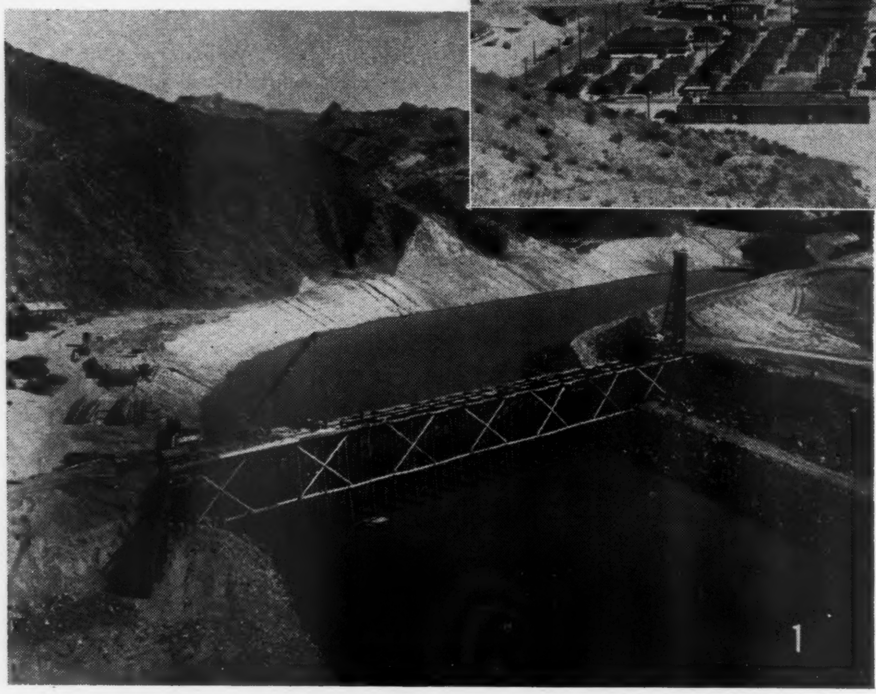
The river fill at the site is composed of sand, gravel, and silt and extends approximately 200 feet down to bedrock. This material is adequate as a foundation for the type of dam under construction, but will be supplemented in the river section by a deep, backfilled cutoff trench and by suitable cutoff walls along the abutments. The dam proper is to be a zoned, rolled earth-and-rock-fill embankment 1600 feet long and rising 138

feet above the river bed. The crest, at Elevation 655, will be 50 feet wide, and the maximum base width will be 1400 feet. The central, impervious zone of the structure and the backfill for the cutoff trench will consist of selected clay, sand, and gravel moistened and rolled in 6-inch layers. A blanket of the same material will extend from the dam axis over the entire upstream part of the foundation. Areas immediately upstream and downstream from the central impervious zone will be covered with semipervious rock screenings, moistened and rolled in 12-inch layers, and the same material will be used to blanket the downstream part of foundation.

The upstream and downstream faces of the embankment will have a layer of dumped riprap of increasing thickness from top to bottom. In the case of the former, the outer slope will be 1 on 2½ to Elevation 645 and 1 on 3 to Elevation 575, where it terminates at a 40-foot-wide berm. Beyond the latter the riprap becomes a rock fill with an outer slope of 1 on 8 and provides a stabilizing weight for the upstream impervious blanket. The outer face of the downstream rock fill will have a slope of 1 on 2½ to Elevation 575, one on 12 to Elevation 556—the grade of the powerhouse access road, and 1 on 3 to the river-bed intersection.

The cutoff trench in the river-bed section of the embankment will be located with its center line parallel to and 75 feet upstream from the dam axis. It will be excavated to a depth such as the foundation materials may necessitate, will have a bottom width of 120 feet, side slopes of 2 on 1, and a compacted backfill of the same materials as those that will make up the impervious and semi-impervious zones of the embankment. A concrete cutoff wall, projecting a maximum of 15 feet into the impervious part of the fill and to a minimum depth of 3 feet into rock formation, will be constructed along each abutment. Grout will be injected into the cutoff-wall foundations for added stability.

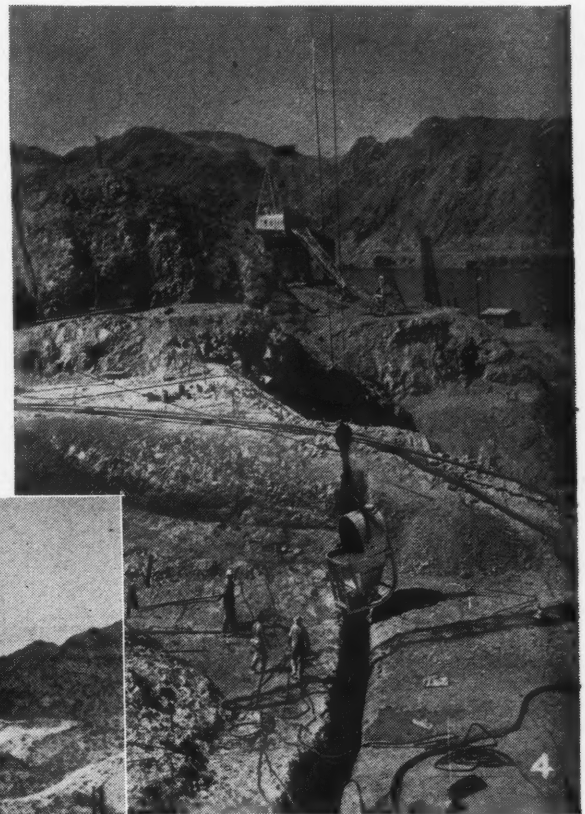


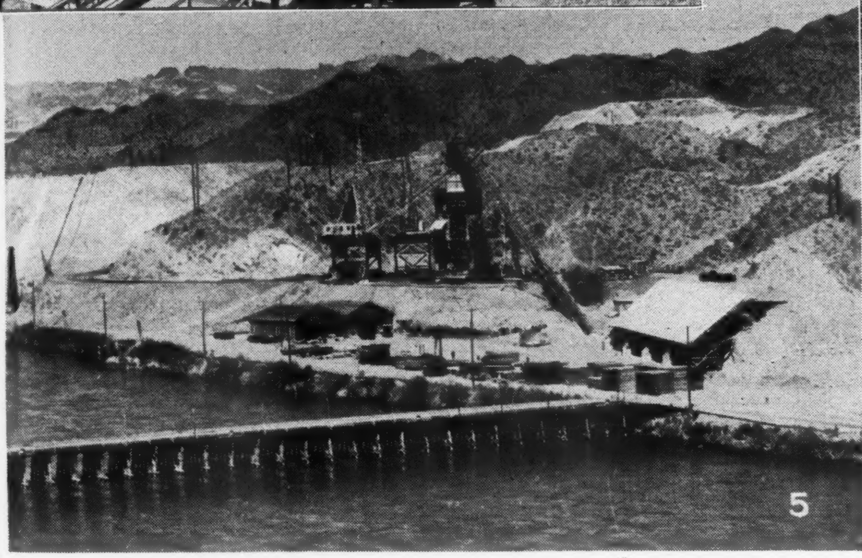


MISCELLANEOUS VIEWS

1– A bridge across the diversion channel. It serves as a haulageway for trucking impervious fill material from a borrow area to the dam site. The contractors have also built four trestles over the river. 2– Housing and other facilities for 1500 persons were constructed downstream from the dam site. This view shows the contractors' settlement in the foreground and the Government town on the opposite bank in Arizona. All cement, lumber, etc., for the dam are being hauled from Kingman, Ariz., by way of the bridge at the left. 3– Steel trestle for placing concrete in the spillway area. 4– The first bucket of concrete poured on the dam site being lowered into the gravity-wall cutoff trench. 5– Aggregate storage area and concrete mixing plant on the Arizona side of the river.

Work on Davis Dam was initially begun on July 29, 1942, under a contract let to the Utah Construction Company, but was stopped the following October by the War Production Board because it was not essential to national defense. Current activities are being carried on under a new award, and authority to proceed with the $22,602,505 contract, gross estimate, was given by the Bureau of Reclamation on March 23, 1946. Operations are scheduled to cover a 3-year period. Utah Construction Company is sponsoring the work and is associated in the enterprise with Morrison-Knudsen, Pacific Bridge Company, McDonald & Kahn, Winston Brothers, J. H. Pomeroy & Company, Inc., Raymond Concrete Pile Company, and Henry Kaiser interests. It is interesting to note that this is the fourth great Colorado barrier to be erected by various combinations of the member firms that made up Six Companies Inc., and that five are included in this large postwar dam project.





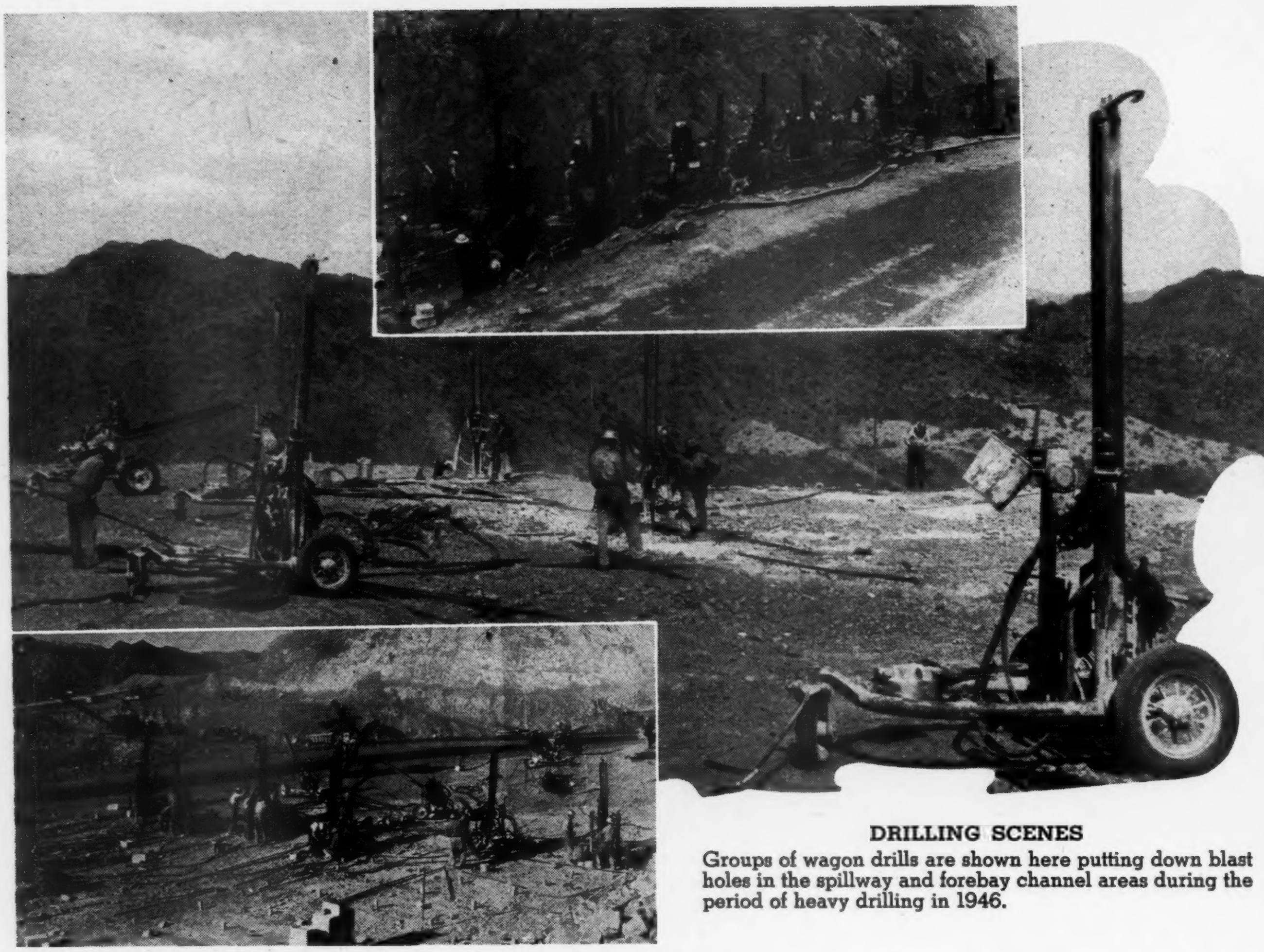
Upon the resumption of work, scarcity of materials complicated the first major job—that of providing housing and other necessary facilities to serve the 1500-odd employees that would be required at the peak of operations. Surplus army dormitories, broken into sections for truck transport, were secured from Camp Williston, the haul of 108 miles including a trip across the top of Hoover Dam. Typical of the resources employed in this connection was the lease of a lumber mill with a weekly capacity of 80,000 board feet. Located near Flagstaff, Ariz., the raw lumber was shipped by the Santa Fe Railroad to a materials yard at Kingman and trucked from there 30 miles to the dam site, where it was planed and resawed. A suitable office building had been erected in 1942.

The contractors' village, with dormitories, some 50 individual houses, a trailer camp, and a grade school employing a principal and three teachers is on the Nevada side of the river. Bus service to Kingman is provided for high-school students. On the Arizona shore, but a part of this self-sufficient community, are both the executive offices and homes of the Bureau of Reclamation staff, which will number up to 200 during certain phases of the work. There is a guest house in the contractors' village for visitors.

Because of the extreme summer temperatures prevailing at the site, all dwellings and public buildings are air conditioned with installations of generous size. Considerable effort has been made to create an oasis in that desert region and an atmosphere of charm by enriching the sand and planting lawns. The settlement even boasts a weekly periodical, the *Dam'n News*. Water from the Colorado is delivered by turbine pumps to a treating plant and hilltop storage tank, that for domestic use being softened by the Zeolite process. Also included in the preparatory work was the construction of three pile trestles across the river and the erection of a steel-frame shop and warehouse facilities north of the contractors' village. Among this group of buildings is a compressor house containing three 17½&29x21-inch, 2200-cfm., PRE machines driven by synchronous motors.

The first big tasks in actual dam construction were: Excavating in granite a 4500-foot-long permanent diversion channel on the Arizona side of the river; and digging, processing, and stockpiling suitable aggregates for concrete. The diversion channel, which reached a maximum depth of 200 feet, involved the removal of four million cubic yards of material. This job was done by a battery of FM2 wagon drills mounting X71 drifters, while JB5 Jackhamers were used for lesser drilling. Most of the spoil was hauled across the timber trestles in fleets of 10- and 13-cubic-yard Euclid trucks and piled on the Nevada shore for placement in the dam's 3,500,000-cubic-yard main embankment. Work on this phase of the project is scheduled to begin this spring and to require about a year.

After the excavation had reached a depth of 100 feet, two zones of broken rock encountered in the forebay area persuaded the board to make additional studies of the foundation for the dam's intake structure. Subsequent changes in plan were based on data secured by intensive core drilling, as well as from the channel excavation, and were approved on March 5, 1947, by a consulting board of five engineers and geologists after investigation on the ground. In consequence, the cost of the dam and related works will be increased by some $6,500,000. The walls of the forebay channel, which had been given a slope of



DRILLING SCENES
Groups of wagon drills are shown here putting down blast holes in the spillway and forebay channel areas during the period of heavy drilling in 1946.

½ to 1, were resloped 1 to 1, and the power-plant intake structure will stand more nearly parallel to the river than originally planned so that its foundation will avoid faulted areas. This, with a slight difference in the powerhouse location, will involve changes in the penstocks.

One 100-foot and two 75-foot tunnels of 5x7-foot section have been driven into the forebay abutments and lined with 2 feet of reinforced concrete. These bores will provide drainage and will give access for grouting operations after the completion of the dam. Because of the resloping of the forebay walls, their concrete lining will be thinner than that initially specified. However, some 150,000 yards of concrete must be poured before the diversion of the river, which is scheduled to take place about May 1.

Sand and gravel suitable for aggregates were located near the dam site, and a screening and washing plant was erected about 2 miles downstream on the Nevada side by the Utah Construction Company. Classified materials are hauled by truck across the river to storage bins on the Arizona shore. These bins are equipped with electrically operated gates and discharge on to an 800-foot-long conveyor belt traveling in a tunnel below them and delivering to an electric tower mixing plant that is provided with automatic weighing recorders.

The larger part of the 500,000 cubic yards of concrete needed for the project will be produced by this plant and will be transported in bottom-dump buckets by railway cars to the pouring points. The buckets will be picked up and dumped by the 125-foot booms of two revolving cranes moving on 43-foot-gauge tracks that are carried through the headworks area on a steel trestle having a maximum height of 95 feet. As the work progresses, parts of this trestle will gradually be embedded in the concrete. The outer end of a gravity wall along the left abutment of the headworks has been poured in 30-yard blocks with transit-mix concrete.

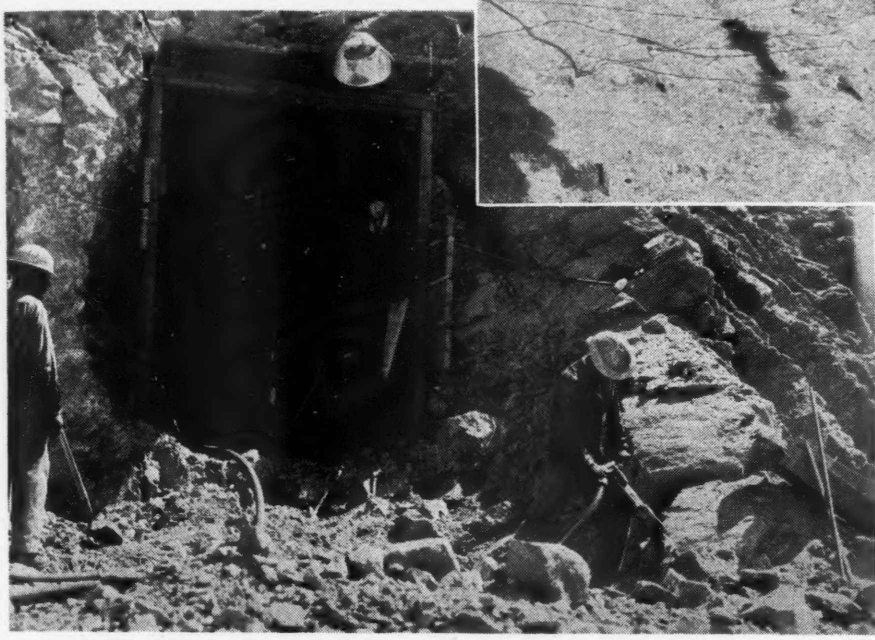
Concrete construction is complicated by the high temperatures prevailing in the desert. Added to this is the heat induced in the concrete itself by chemical reactions involved in setting. Studies made prior to the building of Hoover Dam showed that the temperature rise in the case of large masses is equivalent to 40°F. Therefore, to compensate for heat generated during the critical curing period, it was necessary to remove 965 BTU's per cubic yard for each degree of reduction in temperature, or a total of 38,600 BTU's for each of the 3,325,000 cubic yards in that vast structure. In order to lower the temperature of the concrete to the maximum degree set by the Bureau of Reclamation, a circulating system, consisting of some 662 miles of tubing of different sizes, was embedded in Hoover Dam and a huge refrigerating plant was installed.

The much smaller mass involved in the Davis diversion dam and powerhouse structures simplifies temperature control and hazard from shrinkage cracks. But, even so, provisions had to be made by the contractors to enable them to maintain the 80° placing temperature (maximum) the Bureau considers essential. These begin with such a relatively simple measure as the application of aluminum paint on the two storage silos for cement, which is shipped by rail to Kingman and trucked to the site. The aggregate bins are shaded from the intense heat of the sun by lean-to roofs. River water for mixing concrete will be cooled to 35° by pumping it at the rate of 1000 gallons per hour through a heat exchanger using ammonia refrigeration, and the temperature of the mix will be further reduced, as may be required, by adding crushed ice produced by three machines with a capacity of 60 tons per day. These units are described on Page 66.

Were it not for great subterranean curtains of grout forced under high pressure into drill holes, few really large dams could be constructed and maintained. In many instances, grouting is a more or

GROUTING PROVISIONS

Extensive grouting, now and later, will insure consolidation of the underlying rock. Following discovery of local unsound foundation conditions, the position of the intake structure was shifted and the program of grouting was intensified in the section affected. Three 5x7-foot tunnels have been driven into the forebay abutments to assist drainage and to provide access for drilling grout holes after the dam is completed. The entrances to two of the bores are seen in the view at the right. The other picture shows the unfinished portal of one tunnel, with a man at the right trimming rock with a paving breaker.



less continuous process throughout the service life of such a structure. Although hydrostatic pressures at Davis Dam will be low compared to those at Hoover, the importance of grouting is accentuated by the facts that Davis is being built of earth fill and that the formations encountered in the foundation areas vary widely. The aim is to distribute the grout through suitably spaced holes so that it will completely fill all porous or shattered zones and combine with the native rock to form a seamless monolith underneath the dam's abutments and foundations.

The grouting procedure is based on data accumulated gradually from the time of the first exploratory core drilling. Diamond drills are utilized and holes are of 1⅜-inch diameter. Some exploratory holes have been carried down to a depth of 300 feet, though 175 feet is the maximum for most grout holes. Spacing is worked out in 80- and 40-foot patterns. The corner holes of a square are drilled and grouted; then the holes half way between, plus the one in the center of the block. The smaller squares thus created are next drilled and grouted in the same sequence until the required 10-foot spacing has been obtained. Grout is injected with air-operated pumps, and pressures as high as 400 psi. have been used, causing some displacement and heaving. Lower pressures have proved to be more effective.

The spillway will be gate controlled and have an overflow section with three 50x50-foot fixed wheel gates installed on the crest and operated by vertical-lift hoists. Two outlets, one on each side of the spillway structure, will permit reservoir withdrawals other than through the power plant. Each of these will be controlled by a 22x19-foot, high-head, hoist-operated radial gate. There are to be five generating units in the semioutdoor-type station. Each set will consist of a 45,000-kw., 60-cycle, vertical-shaft generator with a direct-connected exciter driven by a 62,200-hp. turbine of the vertical-shaft, single-runner, Francis type designed to operate at 94.7 rpm. Seven cranes, including a 325-ton gantry, will be provided to handle power-plant equipment.

Water for the production of power will fluctuate between a maximum elevation of 647 feet at flood storage capacity and a minimum of about 570. The centerline of the inlets to the turbine runners will be at Elevation 513, and it is expected that the normal net effective head under which the turbines will operate will vary from a minimum of 110 feet to a maximum of 130 feet. Turbine design calls for the development of 62,200 hp. at full gate opening under a 120-foot net head. A transformer station, to be constructed on the Arizona side of the river, will step down the generator voltage to the required 69- and 230-kv. transmission values.

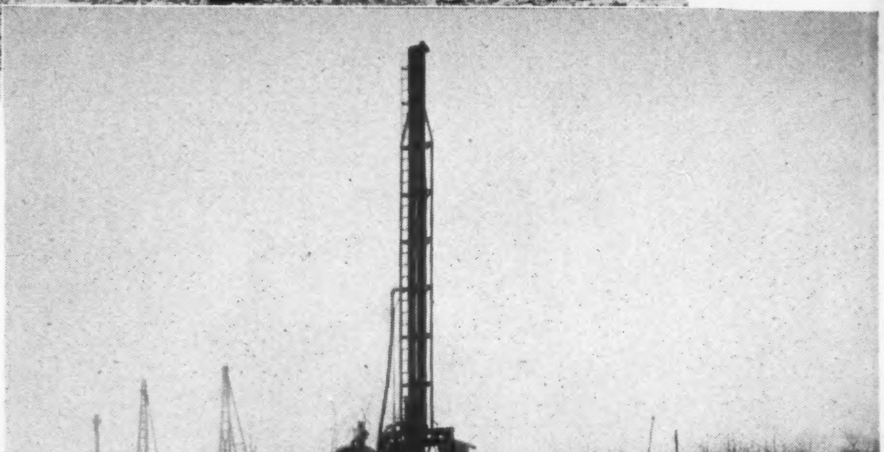
The most effective utilization of the Davis power plant necessitates interconnection with the Hoover and Parker Dam hydroelectric stations and with transmission lines to pumping plants on the Colorado River and Gila projects, as well as systems supplying commerical users. Applications for Davis power received to date exceed the station's capacity, though no allocations have been made.

Construction costs of the Davis Dam Project approximate $104,000,000, based on 1947 prices. Of this total, an estimated $62,000,000 will be spent in building the dam, spillway, powerhouse, terminal facilities, and related works. H. E. Williams is project manager in charge for the contractors, and Ted N. Terry is general superintendent. Government supervision is under Bureau of Reclamation Region 3 with headquarters, under Regional Director E. A. Moritz, at Boulder City, Nev. H. F. Bahmeier is construction engineer for the bureau at the site.

The once heavily silted Colorado now leaves Hoover Dam as a clear-water stream. Consequently, it is adjusting its downstream gradient to the lesser slope required to move without its customary burden. It is cutting in some places, filling in others. In the latter stretches, the Government has a sizable program underway to deepen the channel and to prevent overflowing.

The Quarrymaster

A New Air-Operated Machine for Drilling Large Blast Holes



GENERAL VIEWS

The lower picture shows a machine drilling through 70 feet of trap rock at the White Haven, Pa., quarry of General Crushed Stone Company. When the machine is shipped or moved relatively long distances on the job under its own power its drill tower is laid back, as illustrated at the top of the page. The tower is lowered and raised by the drill-feed air motor.

A SELF-CONTAINED, portable, air-operated rock-drilling plant designed for use wherever large-diameter blast holes are required has been introduced by Ingersoll-Rand Company. It will drill holes up to 6 inches in diameter to depths of 70 feet or more at a rate that promises to reduce production costs in quarries, open-pit mines, and in coal-stripping operations.

Called the Quarrymaster, the unit is a packaged assembly complete with drill, power plant, propulsion elements, and auxiliary equipment, all mounted on tractor treads. It can be quickly moved from hole to hole, accurately spotted for drilling at any designated point, travel overland at a speed of 1 mile per hour, and negotiate grades up to 30 percent. After it has been spotted, it is leveled by vertical hydraulic jacks, one at each corner, that are controlled from the operator's station. Each jack has a large-area footpad that bears against the ground. With all or most of its weight supported by the jacks, the rig remains rigid and practically vibrationless, insuring not only improved drilling performance but properly aligned holes and accurately spaced hole bottoms, an essential if the desired fragmentation of the material is to be obtained upon blasting.

Tests indicate that the Quarrymaster will drill several times faster than the equipment heretofore available for the same class of work. The results are based on trial runs in various kinds of rock, including quartzite, taconite iron ore, magnetiferous iron ore, as well as sandstone and shale overburden in anthracite strip mining. When displayed

CLOSE-UPS

All controls are located within easy reach of the operator at his station in the cab (left). The front-end view, right, shows the drill bar and centralizer through which it passes, the bit, the dust-collecting hood, the flexible suction tube and, in the foreground, two of the leveling jacks with their large-area footpads.

to trade-journal editors at the Phillipsburg, N. J., shops of Ingersoll-Rand on February 5, the machine drilled 47 feet of 6-inch hole in limestone at an average rate of 13.4 feet per hour.

When J. George Leyner made the hammer drill practicable just before the turn of the century by introducing hollow steel, the heavier, slower-striking piston drill was gradually abandoned, except in the subaqueous field where its use persisted because it possessed advantages for that class of work. Its retention for underwater drilling was fortuitous, for it was in seeking to improve the performance of these drill boat-mounted machines that Ingersoll-Rand engineers developed the method of conserving air that contributes notably to the Quarrymaster's operating economy.

The old piston drills were driven by steam, not of necessity but because they were "air hogs." The cylinder spaces at the two ends of the piston were alternately filled and exhausted during each cycle; and if air was used, a compressor of considerable power was required to operate even one drill. The improvement embodied in the Quarrymaster is a new valve cycle. Air, initially under a pressure of 120 psi., is first introduced underneath the piston to raise it, then bypassed to the top of the cylinder for the down stroke, and finally exhausted through the hollow drill bar to clean the hole. Thus, the air is used three times. As a result, the Quarrymaster consumes only about 60 percent as much air as one of the old piston drills of like size. It also works four times faster than its predecessors, delivering around 200 or more blows per minute.

The valve action makes it possible for the drill to function equally well whether working at full stroke or a shortened one. Shortening the stroke is of great aid when collaring a hole or fighting the bit through fractured or fissured rock. Actually, the lower cylinder space is under air pressure all the time the drill is operating. This provides a cushion for the down stroke of the piston to prevent damaging contact with the fronthead. In area, the upper end of the piston is greater than the lower end by the area of the piston rod. Consequently, the downward or accelerating force of the piston is equal to this difference in area times the air-supply pressure.

The puff of air that is sent down the drill bar during each operating cycle blows loose cuttings away just before the bit strikes. Furthermore, the bit is rotated with each upward stroke of the drill to change the position of the cutting edge. These two features combine to insure that the cutting edge will always strike exposed rock and at an angle that will break the maximum amount with each blow. The drill is therefore a rock cutter rather than a rock crusher.

The cuttings removed from the bottom are carried by the air stream up the annular space between the drill bar and the hole, more velocity being imparted to the stream by inducing suction at the hole collar. Upon reaching the surface, the cuttings pass through flexible tubing to the hoppers of a 2-stage dust collector. This serves to keep the abrasive rock dust away from the machinery. Collection of the cuttings also provides a simple way of sampling the material being drilled, which is often desirable in mining and quarrying work.

Under ordinary conditions, the hole-cleaning system as described will suffice. When it does not, supplemental air can be sent down the hole. This is done by manually locking the automatic valve that controls the admission of compressed air alternately to the upper and lower ends of the drill cylinder. In this locked position, the piston is forced down as far as it will go and a passage leading to the hollow drill bar is opened. This makes it possible to exhaust all the air in the receiver into the hole, producing a blast that will force out heavy, wet cuttings or pieces of rock that may have fallen into it.

Unlike previous piston drills that used solid steel, the improved machine is designed for hollow steel which, however, is much heavier and larger than the conventional rods employed with hammer-type drills. It is high-strength, alloy-steel tubing of 3¾-inch outside diameter and 2¾-inch inside diameter and comes in 35-foot lengths. The bits, which are detachable, are made of high-carbon steel and are resharpened by forging. The bit is attached to the end of a drill bar by a tapered API thread that has been used for many years in connection with cable-type drilling machines. The same thread serves to couple two bars for drilling holes deeper than 35 feet.

The hole-cleaning feature previously

mentioned tends to prolong the length of time a bit can be used before it requires resharpening. Tests indicate around 50 percent more footage before dulling than in well-drill service, where sludge in the hole is crushed with each blow before the bit strikes hard rock. Experiments are underway with bits having tungsten-carbide inserts, but these have not gone far enough to permit drawing definite conclusions as to their fitness for the service.

In a sense, the Quarrymaster is a giant-size, self-sufficient wagon drill. The drill moves up and down guides in a vertical tower, which is high enough to accommodate a 35-foot drill bar. The drill and attached bar and bit are raised and lowered by a roller chain the same as in a wagon drill. The chain is powered by a 5-cylinder air motor having a lifting capacity of 16 tons. An adjustable spring-loaded brake permits regulating the drill's rate of feeding in accordance with the drilling speed. Once the adjustment is made, the drill will feed itself as long as the rate of penetration is uniform. The feed-control brake is automatically released whenever air is admitted to the motor.

The drill-feed motor also serves to raise and lower the tower. When the rig has to travel a considerable distance, or when it must pass under an overhead obstruction, the tower can be laid back. Lowering or raising the tower takes half an hour. With its tower down, the Quarrymaster is shipped from the factory as a unit, ready to go to work upon reaching its destination. Although the assembly weighs 21 tons, its over-all dimensions are such that it can be moved over highways on a truck trailer. It runs on and off the trailer under its own power.

The power plant of the Quarrymaster is a standard 500-cfm. Mobilair portable air compressor minus running gear and wheels. It is driven by a diesel engine, but can be furnished with an electric motor, if that is desired. When the Quarrymaster is not drilling, its air plant will be available for other work on a job. It is of sufficient capacity to operate two large wagon drills or five or six Jackhamers.

The propulsion system is the same as that used for many years on Ingersoll-Rand portable compressors and heavy construction equipment. Each caterpillar track is powered by its own reversible air motor acting through double planet-type reduction gears. This provides a high degree of maneuverability. As the main frame of the machine has a 3-point suspension with the track frames, the unit can move over rough ground with a minimum of tipping.

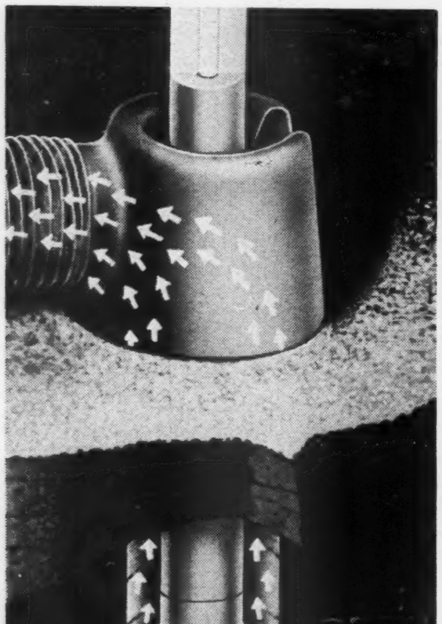
Before they undertook to design the Quarrymaster, Ingersoll-Rand engineers visited various heavy-duty drilling jobs to determine just what operators needed or wanted for putting down primary blast holes. They learned that a new machine, to be accepted by the trade, would have to offer certain improvements over existing equipment. They listed all the desirable points and adopted them as their specifications. The major requirements they sought to meet are:

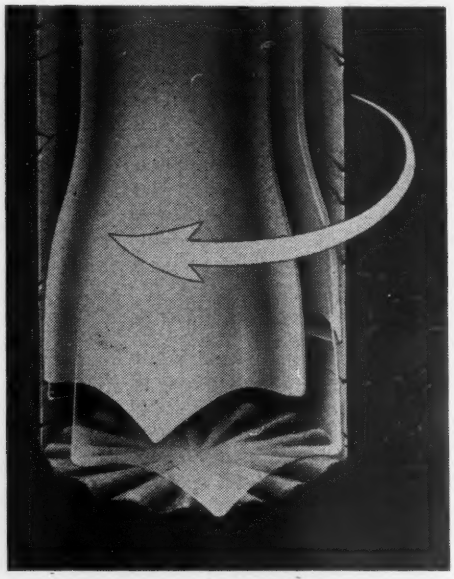
1. Faster drilling, which permits spacing holes closer without increasing drilling costs. Closer-spaced holes insure better fragmentation of the material upon blasting. This, in turn, reduces secondary drilling and blasting, thus facilitating and lowering the cost of loading and crushing operations.
2. Controlled power feed.
3. Automatic rotation, which increases the cutting efficiency of the bit under all conditions and is helpful in drilling through broken and fitchery rock.
4. Continuous removal of cuttings from the hole bottom so that the bit will always work on clean, solid rock.

It was apparent from the beginning that these requirements could best be met with an air-operated machine. In fact, many of the necessary features had long been a part of standard rock-drilling equipment. The most serious problem was that of hole cleaning. The idea of using water for this purpose was discarded immediately because of the difficulties it would impose in freezing weather. It looked like a job for compressed air, but the application of "live" air was ruled out when it was found that 200 cfm. or more would be needed. The problem was finally solved and means devised by which the air could first be used for drilling and then for hole cleaning.

Although no comparable air-operated machine has been built so far, all the component parts of the "Quarrymaster" have been time-tested. For that reason, and also because an experimental model was tried out for an extended period under actual field conditions in several parts of the country, the designers look for fewer operating troubles than usually develop with new equipment.

In design and construction, the Quarrymaster favors easy maintenance and repair. All working parts are readily accessible, and all principal components are substantially self-contained units that can be quickly removed and replaced with duplicates when repairs are needed. The drill-feed and propulsion motors are interchangeable.

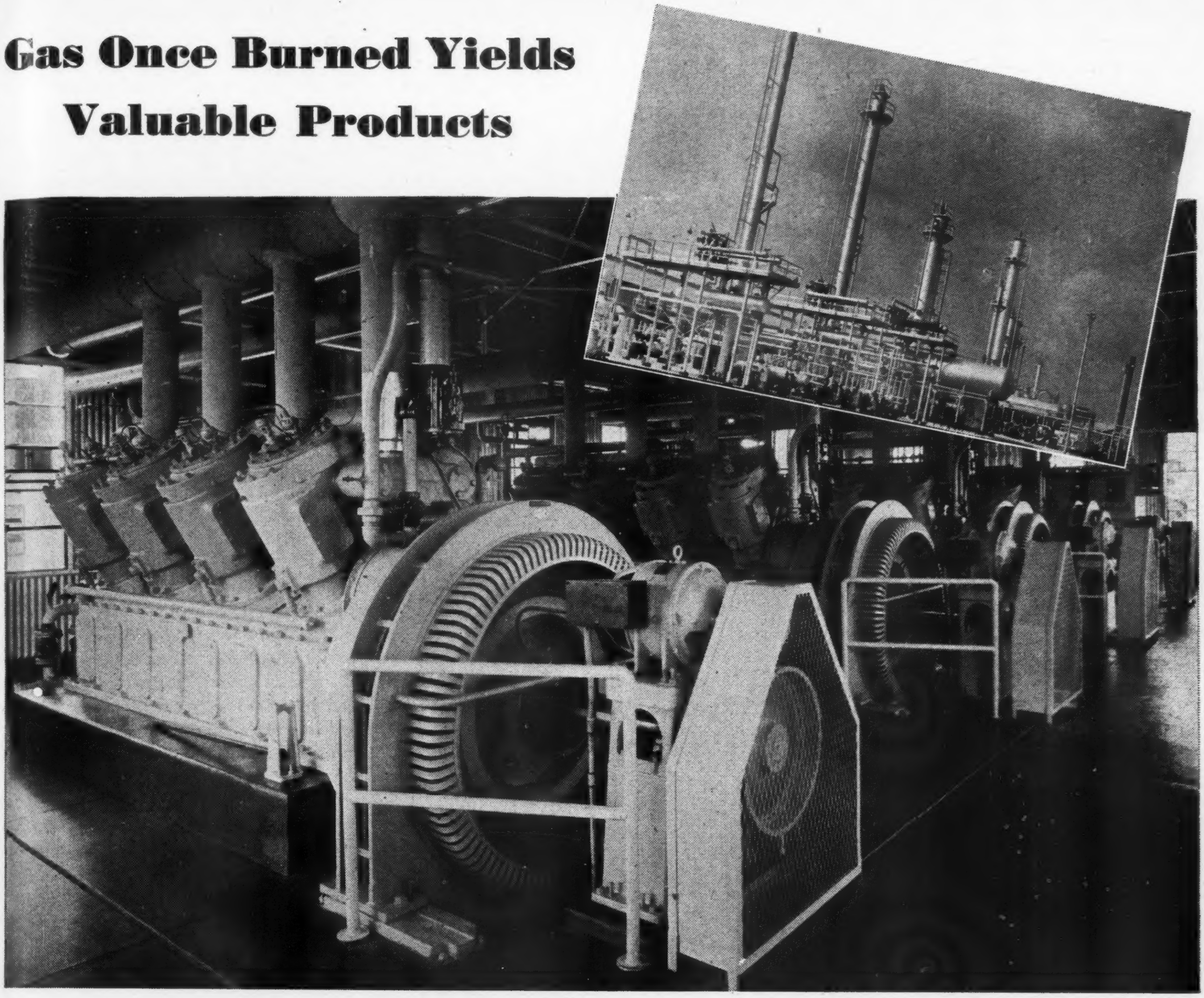




AIDS TO FAST DRILLING

When large-size blast holes are drilled with conventional equipment, water is introduced into the hole and the cuttings form sludge through which the bit must pass before striking solid rock. No water is used with the air-operated Quarrymaster, and cuttings are continually cleared away by sending compressed air down the central hole in the drill bar and bit, as illustrated at the left. The rock particles are carried upward through the space around the tools to a hood at the surface, and thence by a flexible suction tube to a dust collector. The bit therefore always works on a clean rock face. Moreover, with each upward stroke it is rotated a definite extent to a new cutting position (right-hand view), thus enabling it to chip off the maximum possible amount of rock. These features, plus the relatively fast operating rate—200 blows per minute, are responsible for the Quarrymaster's speedy drilling performance.

Gas Once Burned Yields Valuable Products



GENERATING UNITS AND PROCESSING TOWERS

Some of the natural gas brought into the plant provides fuel for driving these four identical engine-generator sets. The current they produce operates all pumps and cooling-tower fans in the plant and lights all buildings, as well as homes of the operating personnel. Each generating unit consists of an Ingersoll-Rand Type PVG, 370-hp., 8-cylinder, 4-cycle gas engine direct connected to a 375-kva., 480-volt, alternating-current generator. At the generator end of each machine is a 125-volt, direct-current exciter that is belt-driven from the main shaft extension. Insert shows the processing towers of the plant. In them, descending oil comes in contact with ascending natural gas and absorbs liquefiable hydrocarbons, which are subsequently recovered from the oil by fractional distillation and condensed. Marketable products are gasoline, butane, propane, and kerosene. After being stripped of these ingredients, the gas is delivered by pipe line to Magnolia's refinery at Beaumont, where it serves as fuel.

A CAMPAIGN designed to reduce the appalling wastage of natural gas produced with petroleum is succeeding, and the flares that have nightly illuminated the skies of the southwestern petroleum-yielding areas are steadily diminishing in number. This desirable conservation movement is a joint undertaking of the various state oil-industry regulatory bodies and of the oil-producing companies. Its potential benefits are twofold. First and foremost, by retaining as much gas as possible in the underground petroleum reservoirs, the pressure that pushes the oil to the surface through wells will be maintained for a longer time and the ultimate oil output will be measurably increased. Second, such gas as is unavoidably released from the ground will be put to gainful use.

Especial emphasis has been placed upon the conservation of this so-called casing-head gas in Texas, the nation's leading petroleum-producing state. During the war period, restrictive measures were not enforced because the paramount objective was to get as much oil as practicable out of the ground to further the Allied military effort. Since 1945, however, the Texas Railroad Commission, which has jurisdiction over oil output in the Lone Star State, has steadily tightened its regulations against the unwarranted dissipation of gas issuing from oil wells.

The Commission has received generally gratifying coöperation from the oil industry, and at the beginning of this year it was announced that a total of 73 projects for utilizing casing-head gas had been either carried out or set up since the present rigid policy was adopted in September of 1945. If and when all of them are carried to conclusion, it is estimated that only 18.4 percent of the state's entire casing head-gas production will be flared. Ten plants for processing the gas were placed in operation in 1947, and the construction of eight others was started. Collectively, they represent expenditures of many millions of dollars by the oil companies.

Among the recently completed facilities is a natural-gasoline extraction plant built by the Magnolia Petroleum Company at Vanderbilt located near the Gulf Coast in the West Ranch Field of Jack-

son County and west of Galveston. It is equipped to handle 60,000,000 cubic feet of gas daily, and from that volume it obtains an average of 40,000 gallons of liquid hydrocarbons. The principal product is gasoline; others are kerosene, butane, and propane. The gas, after being stripped of these valuable ingredients is put into Magnolia's pipe line for transmission to its refinery at Beaumont, where it serves as fuel.

The Vanderbilt plant uses the absorption process, in which the liquefiable hydrocarbons in the gas are taken up by a selected oil that has an affinity for them but not for the dry gas. The oil flows through a tower by gravity, its descent being impeded by a series of bubble trays over which it passes. The gas is introduced at the bottom and bubbles up through the trays, thus being brought in intimate contact with the oil. The absorbed hydrocarbons are recovered from the resultant "rich" oil by distillation. The stripped "lean" oil is then recirculated.

The Vanderbilt plant differs from most natural-gasoline plants in that it processes both low-pressure and high-pressure field gases. Up to 25,000,000 cubic feet of its daily input is casinghead gas that issues from the ground with crude oil and that was formerly burned in flares. This gas is drawn into the plant under a vacuum and is compressed in three stages to 325 psi. After being cooled to 60°F. in conventional heat exchangers supplemented by refrigeration, it goes to a low-pressure absorber where it is brought in contact with the absorption oil. The high-pressure gas, at 1015 psi., comes from fourteen gas wells and is treated at that pressure in two absorbers.

The enriched oil from the three absorption towers is pumped to a still for fractional distillation. It enters at the top of the tower, and as it descends by way of bubble trays it is heated progressively. The gasoline, butane, and propane, being the more volatile of the absorbed hydrocarbons, are vaporized first and pass out of the top of the still. The kerosene fraction is drawn off at the side of the tower, partway down. The absorption oil, now robbed of its charge, continues to the bottom of the still, from which it is pumped back to the absorption towers.

The recovered hydrocarbon vapors go through condensers, and those that do not liquefy there enter a reabsorber, together with some vapor that has "flashed" from the rich oil during the

PUMPS FOR MANY SERVICES

There is a threefold pumping requirement in the plant. First, proper functioning of the absorption process calls for continuous circulation of the absorption oil. Second, the engine and compressor cylinders of the gas engine-driven compressors and the engine cylinders of the gas engine-driven generator units have to be kept cool by circulating water through their jackets. This water is cycled in a closed system, alternately taking up heat in the cylinder jackets and giving it up in heat exchangers in the base of the cooling tower. Finally, a percentage of the liquid products obtained by condensing the distillation vapors has to be returned to the still as reflux and the remainder must be stored and withdrawn later for shipment. All these varied pumping jobs are handled by Ingersoll-Rand centrifugal pumps. The mild Gulf Coast Climate permits stationing them out of doors, without covering.

1– Piping and one of the processing towers form a background for three Type LFV pumps that circulate engine and compressor cooling water. Each unit will handle 2600 gpm.

2– This array of Motorpumps moves finished products to any one of eight tanks, transfers them from one tank to another, or delivers them from tanks to railroad cars or tank trucks in whch they are shipped. Of the six pumps two are rated at 100 gpm., two at 50 gpm., and two at 40 gpm.

3– These two Type CNT pumps, each with a capacity of 380 gpm., circulate lean oil to three absorbers and one reabsorber. The cooling tower is seen in the background.

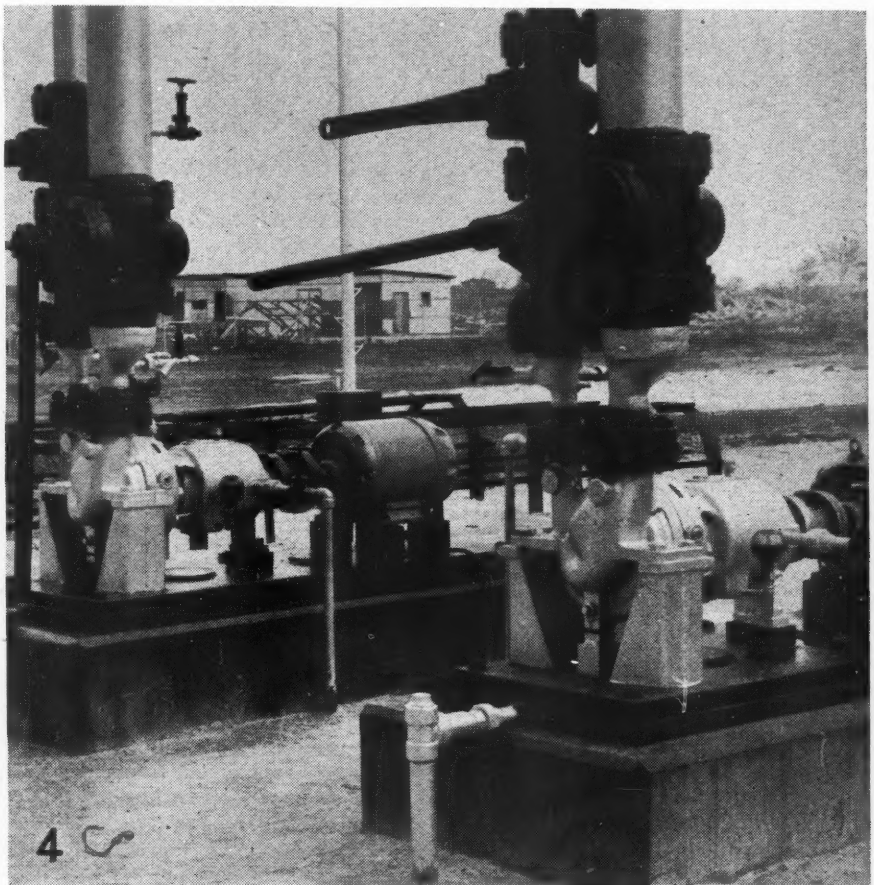
4– Two Type SFL units that pump reflux back into the top of the still. Each will handle 60 gpm.

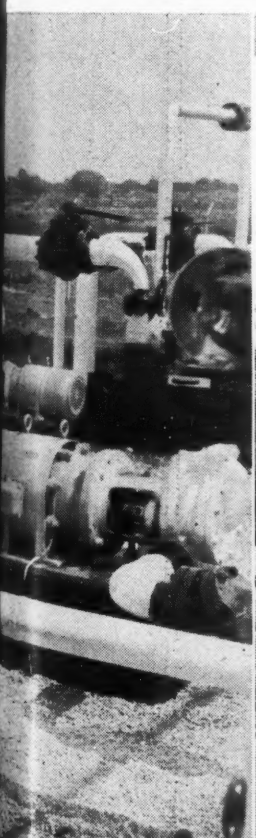
distillation process. The action in the reabsorber duplicates that in the absorbers, the vapors being taken up by lean oil. Proper operation of the still necessitates returning a percentage of the liquefied products to the top of the still in order to maintain the desired temperature there. The remainder is stored in eight horizontal pressure tanks.

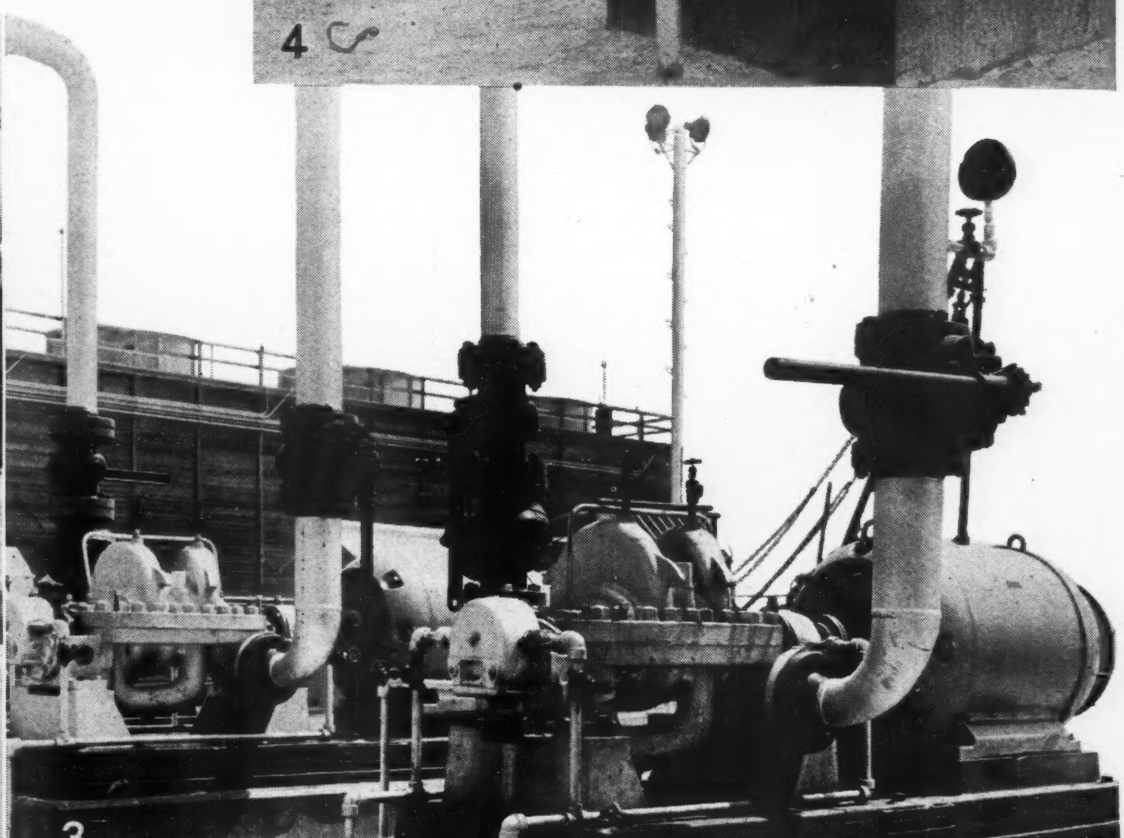
The compressor installation consists of eight machines: five gas engine-driven units compress the casing-head gas to the working pressure of 325 psi., one supplies refrigeration for cooling the compressed gas, and others raise the pressure of the treated casing-head gas to the pipe oil-operating level.

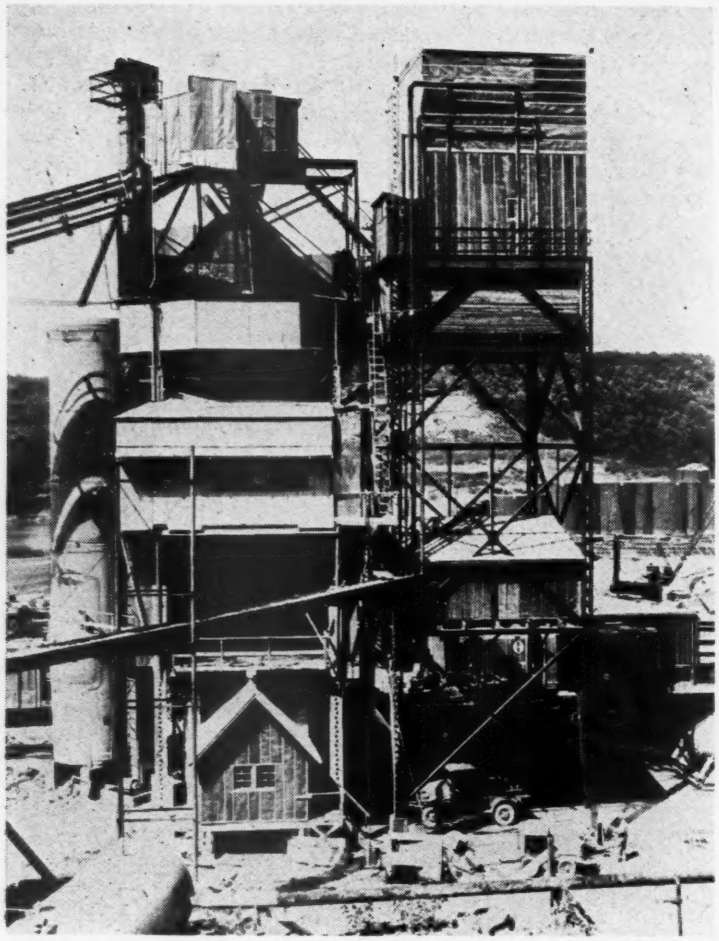
All the pumps required for the various services in the plant are of the Ingersoll-Rand centrifugal type. One group circulates cooling water through the cylinder jackets of the several compressors. After leaving the jackets, the warmed water is cooled in the basin of a cooling tower and, upon being recycled, cools the lubricating oil for the compressors before going back through the cylinder jackets. Another group pumps the absorption oil to the absorbers, reabsorber, and distillation tower. Other units deliver reflux to the top of the still, while still others handle finished distillation products. The lines from the latter are so manifolded that the liquids can be pumped into storage tanks, transferred from tank to tank, or delivered from tanks to tank cars or trucks for shipment.

All the pumps are stationed outdoors, with no cover. This is possible because of the mild climate of the Gulf Coast and is desirable in that housed pumps in hydrocarbon service are a hazard because of accumulations of explosive vapors in case of leaks. They are motor driven, and electricity is also used for running cooling-tower fans and for lighting the plant and the homes of the operating personnel. To meet these needs, power at 480 volts is developed by four 375-kva. alternating-current generators each direct-driven by an Ingersoll-Rand Type PVG, 370-hp., 8-cylinder, 4-cycle gas engine.

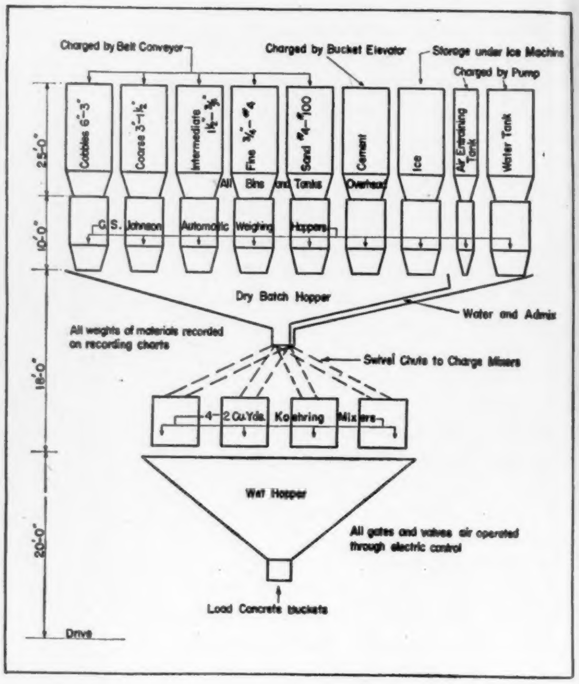






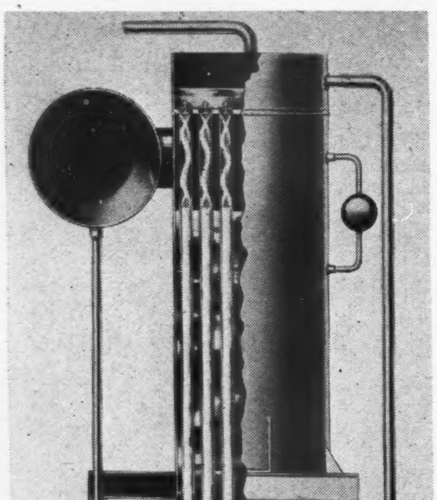


Ice in Mix Precools Concrete for Dams



FORT GIBSON DAM INSTALLATION

The tube-ice machines are in the boxlike structure at the upper right of the 73-foot-high concrete mixing plant. The compressors, condensers, etc., are housed separately. The freezing units occupy a space only 26 feet square, as compared with 3944 square feet for a can-ice installation of equal capacity. Because they are compact and easily dismantled, the Vogt machines can be taken down and set up again. Above, right, is a schematic layout of the batching plant.



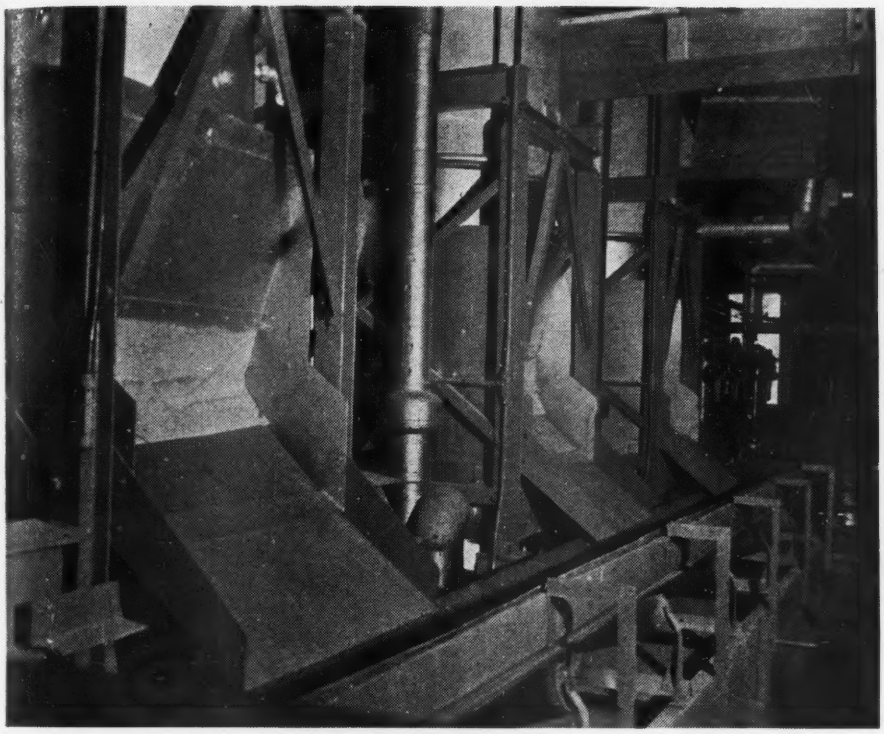
TUBE-ICE MACHINE

Section through a unit showing the freezing cycle.

IN THE article on the construction of Davis Dam (Page 52) mention was made of a refrigerating plant erected on the site to provide crushed ice for use in mixing concrete. This practice, so far as we know, was applied for the first time in Germany in 1939 in building seven dams for a hydroelectric plant in the Harz Mountains. To counteract the temperature rise in concrete caused by chemical reactions during the early stages of hydration or setting, the engineers decided to cool the concrete before placement by mixing it with finely ground ice instead of water. As to the success of the experiment we have no knowledge, but it has been definitely established since then that, except in structures of great magnitude, precooling by this method will keep internal heat within safe limits during the critical curing period and prevent shrinkage cracks. In the case of Hoover Dam, which involved the pouring of 3,325,000 cubic yards of concrete, the same thing was achieved six years earlier by circulating chilled water through tubing embedded in the concrete.

The refrigerating plant at Davis Dam consists of three machines each with a 34-inch-diameter freezer. These supply either ice water or approximately 60 tons of crushed ice or cylinder ice per day. They are of a new type developed by Henry Vogt Machine Company and are known as Automatic Tube-Ice Machines. The product is called Vogtice and is made in small-diameter tubes instead of in the conventional cans or molds providing cakes weighing 300-400 pounds. Freezing is therefore accomplished quickly and without the use of the multiple equipment such as brine tanks and circulators, cans, fillers, dip tanks, dumpers, etc., normally required.

One of our illustrations shows the structural features of the new machine, together with the operating cycle, which is as follows: Water is pumped from a tank at the bottom of the cylindrical housing to the top, where distributors project it against the inner walls of numerous tubes along which it flows in its descent. The refrigerant is admitted into the housing and comes in direct contact with the tubes, causing ice to form



ICE CHUTES

The rubber conveyor belt at the base of the three freezing units at Davis Dam. Its load of either crushed or cylinder ice is dumped into a bucket elevator that delivers it to the concrete mixers by means of a helicoid conveyor. The latter is equipped to control the rate of discharge.

on their inner surfaces. Any water that is not frozen in its passage through the tubes returns to the pumping tank for recirculation. This action continues until ice of the desired thickness is obtained. If crushed ice is desired, thin shells are made; cylinder ice calls for heavier shells.

Once adjusted, the machine starts and stops automatically. Upon the completion of the freezing period, high-pressure gas from a condenser displaces the refrigerant in the housing. This, together with warm water introduced into a thawing chamber beneath the freezing unit, causes the ice to melt sufficiently to loosen it from the walls and to slide down to a motor-driven rotary cutter which, by a simple adjustment, either crushes the tubes or cuts them into pieces of the desired length. This can be done without stopping the machine.

The product is fed on to an inclined metal chute that is provided with a slotted section so that any meltage can flow back into the pumping tank for recirculation. When the ice has been discharged, refrigerant is again admitted to the freezing unit, the pump is started, and the process is repeated. Make-up water is automatically admitted as needed. In addition to producing ice, the machine can be set to supply cold water. This is accomplished by raising the refrigerant evaporating pressure above that required for ice making.

The refrigerating plant at Davis Dam is installed in a building adjacent to the concrete batch plant, and the ice from the freezers is carried by a rubber belt conveyor to a bucket elevator which raises it to a height of 112 feet. From there it is delivered to the mixers by a helicoid conveyor. The proper proportions and weights of dry aggregates, cement, cold water, and sized ice are under precise control in order that the temperature of the batch when it leaves the mixer for placement in the structure will be within the prescribed limits. Experience has shown that the best results are obtained when the concrete is at about 75°F. at that stage and is poured at a temperature not exceeding 80°.

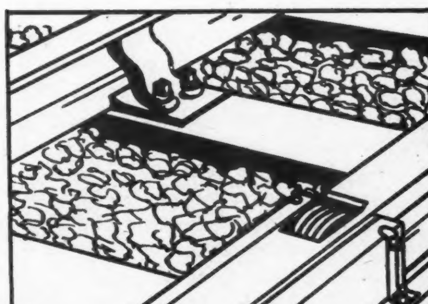
Three machines of the same type but with 48-inch-diameter freezers are in operation on the $32,800,000 Fort Gibson flood control and hydroelectric project 12 miles northeast of Muskogee, Okla., on the Grand River. These units have a total daily capacity of 180 tons and furnish 135 tons of crushed ice and the remaining tonnage in the form of cold water for use in mixing concrete for the dam. About 500,000 cubic yards will enter into that structure, and it is being poured at the rate of 150 cubic yards an hour sixteen hours a day.

Third Rails Equipped with De-Icers that Work

WITH traffic interruptions because of heavy snows and ice still fresh in the minds of many Americans, especially along the northeastern seaboard, it is of interest to learn of a conductor- or third-rail de-icer that was introduced in England during the winter of 1946. The system was developed by members of the London Passenger Transport Board's engineering staff and was used with success on the Bakerloo electric line.

The equipment devised is simple, and consists of a series of metal reservoirs interposed at intervals in the conductor rail. Each reservoir contains an antifreeze solution and a rubber roller that comes in contact with the collector shoes on the cars as the train travels along. The shoes pick up the antifreeze clinging to the roller and spread it on the surface of the track, thus preventing the formation of a crust of ice that might interrupt the transmission of current to the shoes and cause stalling. A small hand lever alongside the equipment puts it in or out of service.

The centers on which the reservoirs are set vary with local conditions, and the length of rail covered by each antifreeze unit depends upon the time it is in use. Continuous running, it has been found, results in the coverage of some miles of track; but as the rails must be treated quickly, the de-icers are placed from 1800 feet to half a mile apart in areas where there is danger of subfreezing temperatures. From about 90 units installed in 1946, the figure has risen to 400 distributed throughout the entire open sections of the existing trackage and recent extensions of the Board's system. Previously, special "sleet trains" were run to spray antifreeze on the conductor rails.



DE-ICING UNIT

Pneumatic Barker Cuts Log Waste

A SIGNIFICANT contribution to the conservation of forest products has apparently been made by the Weyerhaeuser Timber Company, in the State of Washington, with its new air-operated log barker.

Logs intended for processing into plywood have generally been turned in a modified engine lathe while a cutting tool removed the bark. This treatment does the job satisfactorily, but it takes away with the bark around 5 percent of the wood. Aside from this direct loss of wood, the bared outer surface of the log is torn to some extent and must be smoothed before continuous plywood sheets can be obtained by the subsequent "peeling" operation with a cutting tool. In recent years, use has been made of a hydraulic method that loosens the bark by means of high-pressure water jets. The Weyerhaeuser development represents an effort to accomplish the same result in a simpler and less expensive way.

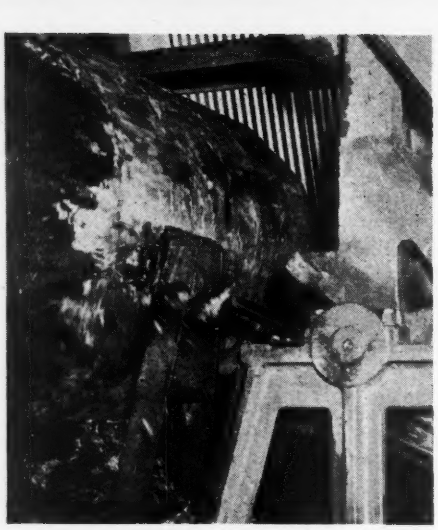
The pneumatic equipment removes the bark by the compressive and shearing action of a rotating wheel that is pressed tight against the surface of the log as the latter turns in a giant lathe. Pressure is obtained by mounting the wheel on the end of a piston that works in an air cylinder. The apparatus is controlled by one man, who rides a carriage that moves the length of the log as the bark is progressively removed.

The debarker is designed on the simple principle that less force is required to crush bark than to crush wood. When the applied force is sufficient, the bark separates at its point of contact with the cambium, which lies between the bark and the wood, thus producing wood-free green bark as one product and bark-free logs as the other. This is accomplished with the inexpensive equipment at low operating cost. Air pressure of about 50 psi. is used, and in the Weyerhaeuser plant is drawn from the regular supply lines extending to various parts of the mill. The average barking time for a log 8 feet long and 40 inches in diameter is 1¾ minutes, which is about the same as with previous facilities.

Because of the clean removal of the bark it is possible to utilize the entire log. In the case of fir logs, which are about 12 percent bark, the latter was formerly considered of little or no commercial value. Now it is converted into ingredients that enter into the manufacture of plastics, insecticides, magnesite flooring, rubber compounds, and many other products. It is processed in the Weyerhaeuser Silvacon plant at Longview, Wash., where a huge plywood plant is likewise located. From the bark is also

DEBARKING A 30-INCH LOG

Pressure of a small wheel held tight against the revolving log by an air cylinder loosens the bark so it falls away. Shielded for protection, the operator controls the mechanism from a platform that moves lengthwise in relation to the log as stripping proceeds. The view above shows bark dropping from a turning log.



obtained glue extender, of which large amounts are used in fabricating plywood. Thus the new equipment provides more wood for plywood veneer, and the bark contributes its natural properties to help make the plywood durable and weatherproof.

The pneumatic barker represents another forward step in the program undertaken to eliminate the waste that formerly characterized the timber-working industry. Sawdust, wood refuse, bark, and mill ends, that once accumulated in great piles and for which there was no market, are now being converted into valuable by-products by research engineers.

The new barker is the result of years of experimentation by the Weyerhaeuser research staff under the direction of C.C. Heritage, the firm's technical adviser. Patents have been applied for, and the company intends to make the process available to the lumber industry generally. Indications are that it will be applied mainly for debarking large logs.

This and That

England Turns to Diesels

Diesel-electric locomotives, which have been used in the United States for more than twenty years and are now being built in far greater numbers than steam engines, are just being introduced in the British Isles. The first experimental main-line, diesel-powered locomotive constructed for the London Midland & Scottish Railway Company was completed in December. It is entirely of British design and manufacture, and embodies a 16-cylinder, V-type, 1600-hp. engine. A duplicate will soon be ready for use. It is proposed to test the locomotives singly in freight service, as well as coupled together to form a 3200-hp. unit for passenger work. Following the trials, the dual unit will replace steam power on an express train on the road's Euston-Glasgow main line.

"Aw, let him go—he's only a little one."

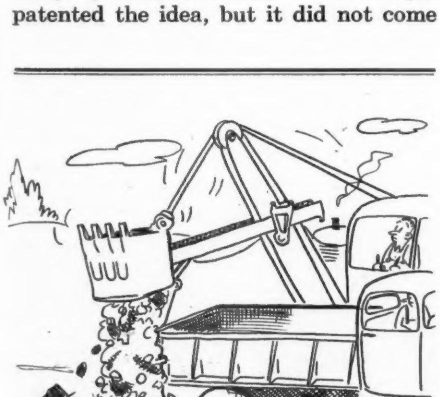
* * *

How Singer Won the Women Over

How Isaac M. Singer, pioneer manufacturer of sewing machines interested the skeptical housewife in his product is recounted by G. B. Tobey in the January issue of *Textile Industries*. Aside from its general interest, our excuse for repeating the incident is the fact that one of Singer's first inventions was a rock drill. With his brother, John A., he had an excavating contract on the Illinois and Michigan Canal in 1838. To expedite the removal of rock, they designed a drill that had a steam piston to raise the heavy steel, which then dropped by gravity. This served to mechanize half of the cycle of the drop or churn drill, which had previously been powered entirely by human muscles. Isaac Singer patented the idea, but it did not come into general use, and another decade elapsed before J. J. Couch, J. W. Fowle, and, later on, Burleigh, Simon Ingersoll, and others conceived wholly mechanical rock drills. Meanwhile, the Singer brothers turned their attention to other fields, and their names did not appear again in connection with the drilling of rock.

In 1850, Isaac Singer, then in New York, built his first sewing machine, which was not an original creation but did include several improvements of designs by Elias Howe, Jr., Allen B. Wilson and Grover and Baker. Singer was granted a patent, and, either because he seemed to know more about manufacturing than his competitors or was more fortunate in obtaining the necessary capital, succeeded in being the first in the market. But the public was not ready to accept the machine and had to be convinced of its advantages. It was here that Singer excelled. He exhibited his invention at fairs and began canvassing homes. Many women were so doubtful as to the machine's merits that they refused to let him in.

Thereupon Singer resorted to strategy that feminine curiosity could not resist. If denied admittance, he would set up his machine on the porch and begin his stitching demonstration. The average housewife, peering out of a window, couldn't long restrain her impulse to see just what he was doing and soon stepped outside. Once she realized how much labor this strange contraption would save her, she was completely won over. Even Singer's competitors gave him credit for doing most to popularize the sewing machine and to break down the sales resistance with which it was originally greeted.



"Nice try!"

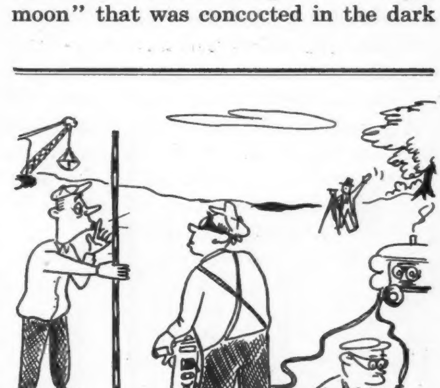
X-Rays in the Yukon

The difficulties involved in safeguarding public health in the remoter precincts of Canada are brought out by the Dominion's Department of External Affairs in a recent issue of its *Weekly Bulletin*. In furtherance of an antituberculosis campaign in the area centering on Whitehorse, Yukon Territory, the Royal Canadian Army Medical Corps is assisting the local civilian medical officer in the X-ray examination of all residents within traveling distance of the city. The work was undertaken in mid-January and is expected to continue through most of the winter. Tubercular suspects are placed in the Northwest Highway System's hospital for treatment. In the case of Indian residents, the X-ray plates are forwarded to Edmonton, Alta., for verification, and authorities there arrange for the disposition of the patients. After the spring ice breakup, medical men will carry the search farther by making a trip down the Yukon River as far as Dawson. Shortage of X-ray plates, which impeded the work during its early weeks, was alleviated by flying a 400-pound shipment from Sea Island, Vancouver, to Whitehorse. Delivery was made in 2½ days.

* * *

Joplin Mines Seen as Haven from Bombs

Few uses have ever been found for worked out mines. Occasionally, when in a favorable location, they have served for cheese making or mushroom culture. And during the prohibition era it was no secret that moonshiners were carrying on their illicit operations in the abandoned workings of some of the western camps. The "sugar moon" that was concocted in the dark



"S-h-h- fellows. We're doing the mental work, you know."

and musty caverns virtually underneath Leadville's streets enjoyed a ready sale in Denver and acquired more than a local reputation as a nonlethal stimulant. By and large, however, after ore production ceased, the underground labyrinths have been allowed to fill with water, and no one has thought much more about them.

With the advent of atomic warfare, however, subterranean spaces may take on a new aspect. Already it has been suggested that thought be given to establishing munitions plants and other war-essential factories in the man-made catacombs of the Tri-State lead and zinc mining district around Joplin, Mo. The region has yielded around a billion dollars worth of metals, and some of its mines, after 30 or 40 years of activity, have become exhausted.

The workings are huge in lateral extent, with high roofs that provide plenty of headroom. Many of them are artificially ventilated and electrically lighted. They are from 50 to 300 feet beneath the surface, being reached through vertical shafts. Moreover, they are in about the center of the country, far from any coast. Military procurement officers are reported to have surveyed the area recently because of the physical advantages it offers as a defense center. Should their investigations crystallize, steps will be taken to continue pumping operations and to maintain the workings in a dry condition pending actual occupation.

"Is this seat taken?"

Premium Gasoline Obstacles

The announced intention of some automobile makers to build cars by October of this year with engines of new high-compression ratios has posed a problem for the petroleum-refining industry. To perform satisfactorily, the engines will require gasoline of 93-octane rating, which is five or more points higher than the octane number of the current national average of premium gasoline. Catalytic cracking is the only practical process by which this new antiknock fuel can be produced, for other available methods are more expensive. Increasing the octane value reduces both the refinery charging capacity and the yield, and we can ill afford this at a time when the demand for regular-grade gasoline is growing and stocks are dangerously low. According to Walter Miller, petroleum-refinery consultant, writing in the February issue of *Mining and Metallurgy*, the only solution is an increase in crude-oil supplies and refining equipment. It would require several years and hundreds of millions of dollars to provide the latter, according to Mr. Miller.

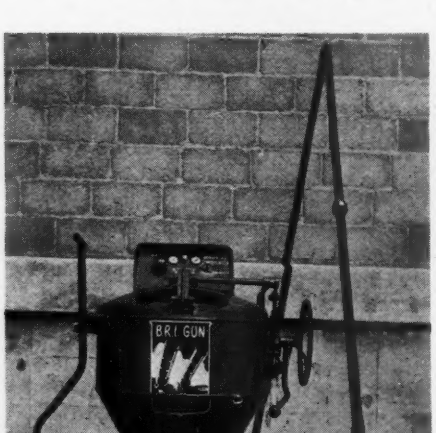
Pneumatic Gun Speeds Furnace Repair

MAINTENANCE of furnaces in steel mills may be speeded up considerably, according to Basic Refractories, Inc., by the use of its new-model pneumatic gun that is designed to place refractory materials on vertical or inclined wall structures at the rate of 100 pounds per minute. Although intended primarily for metallurgical industries, the equipment is also suitable for the repair of industrial steam boilers, etc., and handles refractories not exceeding ¼ inch in size in the dry condition.

Consisting primarily of a hopper having a capacity of 5 cubic feet, the gun is mounted on a welded-steel chassis with a handle and roller-bearing, rubber-tired wheels to facilitate moving it about. A manually operated ball valve regulates the flow of the refractory from the hopper to a shooting chamber, where a jet of air picks up the material, forces it through an attached rubber hose, and expels it from a metal pipe or nozzle. Water, supplied at the rate of approximately 12 pounds per minute, wets the refractory shortly before it is placed. The unit requires about 120 cubic feet of air per minute at a pressure of 50-60 psi. at the discharge end, and the hopper pressure can be varied between 0 and 30 psi., increased pressure resulting in greater delivery. Valves and gauges control the air admitted to the hopper and shooting chamber, and a relief valve prevents the building up of excess pressure.

Two kinds of refractories are supplied by the company for use in the pneumatic gun: Gunmix and Gunchrome. The former is a basic refractory consisting of a mixture of sized, dead-burned dolomite and stable magnesia clinker, with bonding agents added. It has a wide field in the maintenance of basic brick walls of metallurgical furnaces, and may be applied to basic sections of soaking pits, as well as to the brick sidewalls and fireclay copings of these pits. Newer applications include the plugging of tap holes and the making of major repairs in open-hearth furnaces while they are in operation. It is claimed that the maintenance of electric-furnace linings with this material has increased sidewall life by as much as 50 percent.

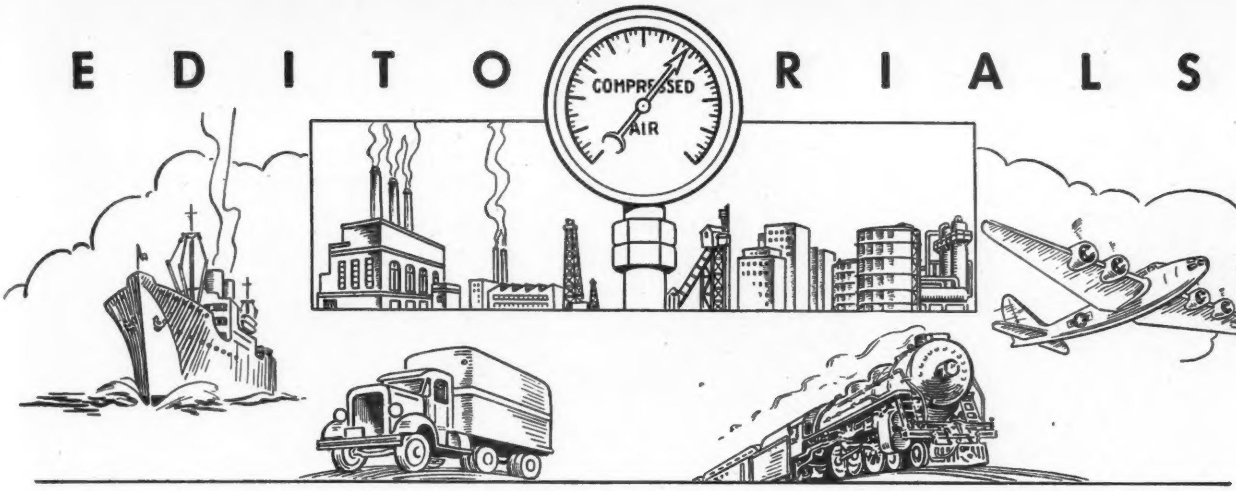
Gunchrome is a neutral refractory composed of sized chrome ore to which bonding agents and a plasticizer have been added. The chrome base permits use of the material on sections of furnace brickwork such as open-hearth backwalls with which basic and acid refractories are in contact. It is also suitable for the maintenance of ports, monkeywalls, uptakes, bridges, frontwalls, and other elements of furnace structures that normally are hard to repair.



IMPROVED PLACER

The new gun with hose and shooting pipe is shown at the left. • Pictured above is the frontwall pier of an open-hearth furnace being repaired with Gunchrome by the use of a curved shooting pipe. The hopper holds 800 pounds of the latter refractory or 600 pounds of Gunmix.

EDITORIALS



OIL FOR THE FUTURE

DURING the war there was continual emphasis on the essentiality of oil to Allied victory. Rationed motorists were eagerly awaiting peace and its promise of full gasoline tanks as of yore. The average person little reckoned that there could be a shortage of petroleum products after fighting had ceased. Yet here we are, well into the third year of peace, and oil is again scarce. Critical shortages of fuel oil developed in some sections during the recent prolonged cold spell. To meet them, refineries had to curtail the production of gasoline, which they would normally have been storing to meet the heavy requirements of the coming summer. This increases the possibility of a curb on gasoline consumption later in the year, either by voluntary action or government regulation.

The petroleum shortage is not grave, yet it is serious enough to cause us to appraise future prospects. Our domestic daily output of nearly 5,400,000 barrels of crude oil is admittedly barely sufficient to meet the country's needs. The Bureau of Mines foresees a demand for more than six million barrels by 1951. Although we have proved reserves of 21 billion barrels, we are discovering new fields at only 40 percent of the prewar rate, and the time is inevitably approaching when we must turn to other sources of liquid fuel.

Fortunately our supply of potential raw materials is huge. Natural gas, coal, and oil shale are abundant, and methods of processing them, while not fully developed, are well advanced, while research is extensive. With petroleum prices trending upward, estimated production costs of synthetic fuels are within or near the range of competition with natural crude oil. However, these costs are based on large-capacity plants, which are still largely on paper, or even in the brains of technicians. Huge outlays of money and materials would be required to build them. James Forrestal and J. A. Krug, secretaries of our Defense and Interior departments, respectively, say that our future welfare justifies embarking on an 8- or 9-billion-dollar long-range construction program, but they admit that this is too big a load for private companies to carry without government help. Expenditures such as they advocate would, it is estimated, provide facilities for the production of around two million barrels of synthetic oil daily. The plants would, however, consume about sixteen million tons of our none-too-plentiful steel and take from five to ten years to build.

Oil-industry leaders want to proceed more cautiously. They say that the money and steel needed to consummate such a program would yield oil quicker if spent in developing American-controlled petroleum lands abroad, notably in South America. They are, however, vigorously pushing their research in the synthetic field. Much of this is concerned with the conversion of natural gas into liquid fuels, and two plants for that purpose are now going up in the West, one in Kansas and one in Texas. Each will have a daily capacity of 7000 barrels of oil to be refined in the usual manner into a wide range of fuels, including gasoline of good quality.

The technique by which the gas-to-liquid conversion is effected has been pretty well solved, and additional plants of this type may be expected shortly. Authorities say that our natural-gas reserves could easily maintain a daily production of 250,000 barrels of refining stock and leave ample supplies for direct use as fuel. These establishments would probably cost in excess of $50,000,000 each under present conditions, and more than 30 of them would be required to sustain the output just mentioned. Contrary to the situation in crude-oil reserves, our known supply of natural gas in the ground is growing all the while, and discoveries of new fields more than keep pace with consumption.

Meanwhile, the coal industry, keenly aware of the fact that it has lost business to liquid and gaseous fuels, is beginning to explore the vast possibilities of its product as a source of oil and gas. The Pittsburgh Consolidation Coal Company is preparing to erect a $300,000 pilot plant at Library, Pa. If the experiments are satisfactory, a $120,000,000 plant is to be built. Standard Oil Company of New Jersey and Hydrocarbon Research, Inc., are coöperating in the pilot-plant project. The former, through Standard Oil Development Company, has already developed a commercial process for making liquid and gaseous fuels from the synthesis gas (carbon monoxide and hydrogen) which is the common intermediate product of both coal distillation and natural-gas conversion. The Bureau of Mines, working along similar lines, expects to have a coal-to-oil experimental plant in operation in Louisiana, Mo., sometime next summer. United States coal reserves are of astronomical proportions and will last hundreds of years, even if conversion to oil becomes a regular practice.

Our third huge potential source of liquid hydrocarbon, oil shale, is under investigation by the Government at Rifle, Colo. It was recently reported from there that shale oil can now be extracted at a cost comparable to the prevailing price of crude oil. The product, however, does not equal good-grade petroleum. It is a viscous, tarlike substance that yields good fuel oil, no kerosene, and gasoline of less than 60-octane rating. The latter can be made into fuel for automobiles, but is not a suitable base for the manufacture of aviation gasoline. It is conservatively estimated that Colorado, Utah, and Wyoming shales contain 300 billion barrels of oil, with about 90 percent of the deposits in Colorado.

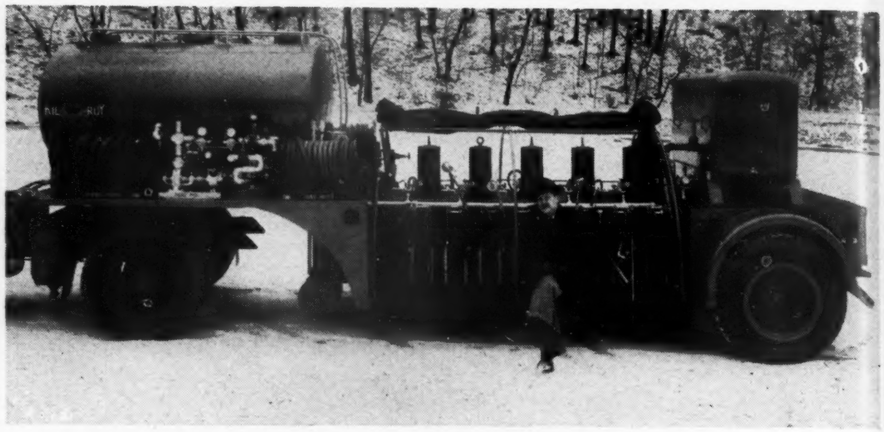
From these facts, plans, and activities can be deduced that we may at times be pinched for a particular liquid hydrocarbon but that we are in no danger of draining the national sources of supply for a good many centuries. Long before they are depleted, atomic power may, perhaps, be harnessed to turn the wheels of commerce and industry.

Service Station on Wheels

MECHANIZED units operating on heavy construction projects can be serviced on the job by a new portable service station. Mounted on a 21-foot, 4-wheel trailer, the mobile unit is 8 feet 3 inches high, less than 8 feet wide, and weighs 11,000 pounds empty and 18,000 pounds loaded. It can carry 700 gallons of gasoline and diesel fuel, 200 gallons of different oils and greases, and 60 gallons of water or antifreeze, as well as smaller quantities of kerosene and other supplies.

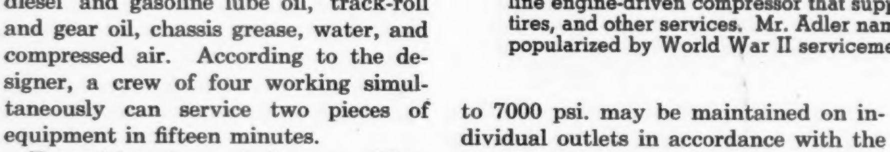
Any conventional truck-type tractor can be utilized to move the unit to the working site, where the tractor can be uncoupled for use elsewhere. Machines to be serviced are brought to the trailer, the central part of which is made up of fuel tanks built into the channel members and chassis. On each side of the tank assembly is a battery of nine hose reels for dispensing gasoline, diesel fuel, diesel and gasoline lube oil, track-roll and gear oil, chassis grease, water, and compressed air. According to the designer, a crew of four working simultaneously can service two pieces of equipment in fifteen minutes.

Everything from fueling to filling radiators is operated and controlled by compressed air, which is furnished by a 60-cfm. gasoline engine-driven machine. By means of regulators, any pressure up to 7000 psi. may be maintained on individual outlets in accordance with the bearings being serviced. Explosion-proof air motors are used to dispense both fuel and lubricants. When the unit has discharged its load, it is towed to a source of supply and the compressor serves to fill the fuel tanks at the rate of 50 gpm., with a maximum suction lift of 20 feet. It is reported that the service station, facetiously called Kilroy because of its mobility, has successfully passed initial tests and is to be manufactured by Jax, Inc., of Pittsburgh, Pa.



THE INVENTOR CALLS IT "KILROY"

Side view of a mobile service unit and its inventor, John H. Adler, of Pittsburgh, Pa., formerly a lubricating engineer with an oil company. At the left may be seen fuel tanks, together with pumps and hose reels used to dispense the fuel. Greases and other supplies are carried in the center section, which is fitted with a removable cover to give protection in bad weather. In the housing at the right end is a gasoline engine-driven compressor that supplies air for operating the pumps, inflating tires, and other services. Mr. Adler named his creation after the legendary figure popularized by World War II servicemen.



U. S. BUREAU OF RECLAMATION PHOTO

BIDS ASKED FOR FOURTH LARGEST CONCRETE DAM

On April 1, the U.S. Bureau of Reclamation will open bids for the construction of a barrier across the South Fork of Flathead River, 9 miles from Columbia Falls, Mont. Power production, flood control, provision of water for irrigating western Montana lands, and regulation of the Columbia's flow to increase the firm-power capacities of existing Columbia River plants are listed as its potential benefits. The 2115-foot-long concrete arch dam will rise 520 feet above the foundation and, with appurtenant structures, will require approximately 3 million cubic yards of concrete. The output of four 75,000-kw. units will be integrated with the Bonneville and Grand Coulee systems and other plants in the Northwest power pool. Construction time allotted is 2000 days, and estimated peak employment will call for 3000 to 4000 workers. While the dam is rising, the river will be diverted through a 36-foot-diameter tunnel, 1100 feet long, which is now being driven by the Guy F. Atkinson Company of San Francisco. A camp to house the Government staff and an 8-mile access road have already been built. The structure will be known as Hungry Horse Dam.

Building Material from Volcanic Ash

HITHERTO considered worthless, the millions of tons of volcanic ash in Oklahoma and other states of the Southwest may become a valuable asset as the result of a process developed by A. L. Burwell, chemical engineer for the Oklahoma Geological Survey stationed at the University of Oklahoma. Mr. Burwell has succeeded in converting the gray, powdery substance into what he calls Pumicell, an industrial building and insulating material that is proof against fire, rot, and vermin and that can by handled like wood. Mining of the vast deposits is estimated to cost less than 50 cents a ton, as it involves nothing more than excavating it with power shovels and dumping it into trucks for removal to the processing plants.

Heat-treated to a temperature of 1962°F., the ash shrinks and turns red; at 2160° it becomes gray and expands and continues to swell as the heat grows in intensity. Because of these characteristics the material can be made into building brick, slabs, or strips weighing 18 to 56 pounds per cubic foot and having a maximum strength of 4200 psi. Mr. Burwell has turned his findings over to the University's Research Institute, which has the right to grant licenses for the production of Pumicell.

Filter Tanks Kept Free of Ice by Compressed Air

TO PREVENT the formation of ice in six outdoor units of a new water filtration plant being built for the City of Pasco, Wash., the designers plan to use bubbles of compressed air in accordance with the Brasher System. The scheme, though of an experimental nature so far as coagulation tanks and sand filters are concerned, is expected to work, and is based on an installation of a humanitarian type in Juneau Park in Milwaukee, Wis. The latter was laid out by an engineer of Allis-Chalmers Manufacturing Company and keeps a lagoon open the year round so that migrating ducks and other wild fowl can rest upon the surface without danger of being caught in an icy grip.

The plant, with a capacity of 6,000,000 gallons a day, will have another distinctive feature: 2-stage sedimentation that will permit the removal of most of the river sand and silt entrained in the water. The presedimentation tank is 20x50 feet in size and equipped with mechanical scrapers. Before the flow reaches that unit, it passes first through a flash mixing basin where alum is added and then through two slow-mixing basins provided with paddles on vertical shafts. The purpose of the presedimentation tank is to segregate the larger pieces of floc so that the main or coagulation basins next in line can operate for a longer period between shutdowns for cleaning than they would under normal conditions.

Each of the two 34x125-foot coagulation basins and the four rapid sand filters that follow are to be protected against the formation of ice by agitating the water with compressed air. The method is being tried because of its simplicity and low cost, as compared with the greater outlay that would be involved if buildings were erected over them. Air requirements for the system will be low, as the latter will be in use only periodically, or when the thermometer registers below 30°F.

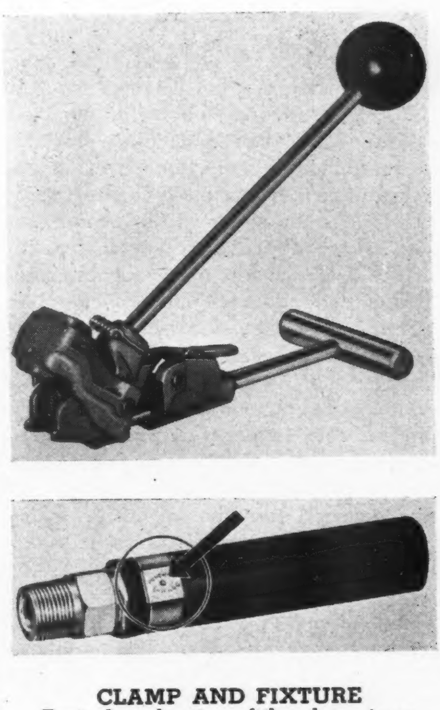
All six units will be served by a 5-hp. compressor that will supply approximately 30 cubic feet of air per minute at 5 psi. The piping used will be of ½- and ¾-inch diameter with 1/32-inch perforations spaced on 1-inch centers. It will be placed along the perimeter of the basins—near the bottom in the case of the main sedimentation tanks and just above the level of the sand in the filters. Operation is automatic and controlled by a thermostat that is set to start the compressor when the temperature of the atmosphere drops below the freezing point. The machine will continue to function and send streams of air bubbles up through the water until the weather moderates, or the predetermined temperature is reached at which the thermostat shuts down the compressor.

The water to be treated by the filtering plant will be taken directly from the Columbia River, which is said to be only a few degrees above freezing the year round. The protective system will therefore receive a thorough try-out and, if successful, may serve as a pattern for installations similarly exposed. The plant was designed by John C. Cunningham and associates of Portland, Oreg.

Locking Tool Clamps Hose to Fittings

RUBBER hose carrying air or gas may be securely clamped to couplings and other fittings by a method devised by the Punch-Lok Company. The clamp is a steel band which is wrapped twice around a hose and is threaded through a metal sleeve. It is then drawn tight by a special tool that puts it under a tension of 1000 pounds and is locked by a hammer blow struck on a punch, which is a part of the tool. The clamp can be put on in a few minutes and is said to provide a leakproof seal that vibration or rough handling will not loosen.

Although intended primarily for clamping hose, the method may be used for splicing welding cables, clamping ground wires, and tapping power lines. Other applications include the fixing of ladder rails and rungs; clamping the split ends of posts, beams, and planks; assembling and repairing wooden water pipes; and fastening patches over holes in metal or tile pipe. Clamps of two types of different materials are available: preformed, for hose of varying sizes, and open-end clamps that can be attached to hose after it is in position. The locking tool comes in two models and can be readily converted from a hand-held to a bench tool. The company carries a complete line of air- and gas-hose fittings for use in connection with the Punch-Lok banding method.



CLAMP AND FIXTURE
Typical application of the clamp to an air hose (below) with the Punch-Lock circled, and the tool with which the clamping is done.

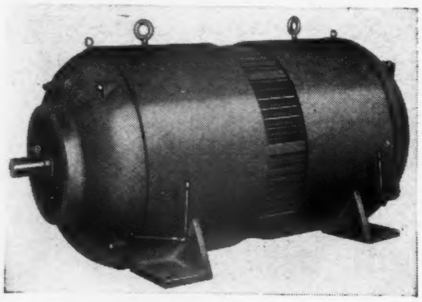
Air-Powered Light for Night and Underground Work

HOW to provide adequate lighting on such jobs as shaft sinking, mining, quarrying, night construction, and other work where the scene of action changes quickly is often a problem. One solution has been found by Ingersoll-Rand Company, which has developed a small, portable, air-powered electric generator that takes its energy from compressed-air lines. Known as Airlite, the unit consumes 10 cfm. at 90 psi. pressure and delivers 150 watts at 115 volts. It will therefore serve two 75-watt lamps and one 150-watt light. All working parts are compactly assembled in a case 7¼ inches long and 5 inches high, weighing 8¾ pounds, complete. It is provided with a handle to facilitate moving it from place to place.

The generator can be carried anywhere, and will operate under the most adverse conditions. Submergence in water, short circuits, or overloads will not damage it; and if its output terminals are shorted, light will be restored as soon as the short is removed. Another advantage claimed for it is that mine electricians and public-utility men need not work on "hot" circuits, for even if the regular power supply is shut off an Airlite may be used to furnish the light necessary for making repairs.

Industrial Notes

For the direct drive of pumps, compressors, high-speed blowers, and other equipment operating in the presence of excessive moisture or dust of an abrasive or conducting nature, Burke Electric Company is offering its 2-pole, totally encased, fan-cooled squirrel-cage motor in a redesigned form. The windings are completely inclosed, and the bearing brackets and external fans are within an outer end shield that directs the flow of cooling air over the bearings and up through the radiators within the outer shell, discharging it through a center opening. The motor is of the normal-



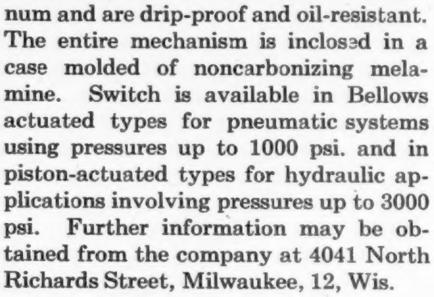
starting-torque, low-starting-current type suitable for full-voltage starting. It is rated at 250-500 hp., and is available for 3- or 2-phase, 60-cycle, 440-, 550-, or 2300-volt operation. Pictured is the 350-hp., 3600-rpm. unit.

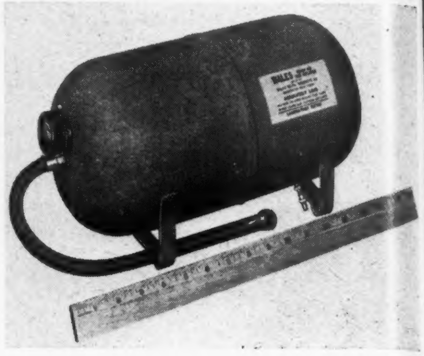
It is reported that General Electric Company has a new, fully automatic machine in operation that cleans, rustproofs, paints, and dries parts passing through it at the rate of nearly 13,000 an hour.

For registering both indoor and outdoor temperatures in home or office, the Jas. P. Marsh Corporation has produced a thermometer of the dial type that is as easy to read as a mantle clock. It may be located anywhere within a room, and indicates the outside temperature by the aid of a small tube placed between the sash and sill of a nearby window. The face of the instrument, called the Marsh Duo-Temp, is divided into two scales: the top one in black shows the outdoor temperature, and the lower one in red the indoor temperature. The thermometer is in a baked-enamel case.

Powdered alloy and a plastic binder, extruded to form wire for use in metal spray guns, is being offered both by Metallizing Engineering Company and Wall Colmonoy Corporation for hard-facing metal surfaces. The binder is completely volatilized during application of the material—the powdered alloy only is deposited. The latter is then variously fused and permanently bonded to the metal base by an oxyacetylene torch, induction heating equipment, controlled-atmosphere furnace, or by a spray gun with a special attachment. The resultant coating is said to be identical to that obtained when the same alloy is applied in rod form by other methods. The wire is available in 1/8- and 3/16-inch diameters in 5-pound coils.

Square D Company has recently introduced a new pressure switch designed for the control of pneumatic or hydraulic systems such as are used on welding equipment, machine tools, and high-pressure lubricating apparatus. Rapid make-and-break action is obtained by a single-pole, double-throw, snap-switch mechanism, and it is claimed that maximum operating rates of 300 per minute have been reached. Separated, non-overlapping, normally open and normally closed circuits with double-break silver contacts are provided. Adjustment of the control point is effected by means of a screw driver or an external knob. A trip indicator behind a window in the cover facilitates setting the trip point and also indicates any pressure surge or other objectionable condition. Switch enclosures are of die-cast aluminum and are drip-proof and oil-resistant. The entire mechanism is inclosed in a case molded of noncarbonizing melamine. Switch is available in Bellows actuated types for pneumatic systems using pressures up to 1000 psi. and in piston-actuated types for hydraulic applications involving pressures up to 3000 psi. Further information may be obtained from the company at 4041 North Richards Street, Milwaukee, 12, Wis.





EMERGENCY TIRE INFLATER

Latest boon to the motorist is this small tank that enables him to carry a supply of compressed air for emergency use when a flat tire or slow leak develops. Only 14 inches long by 7 inches in diameter, and weighing but 5 pounds, it can be stowed in a corner of the car's trunk. It has a gauge showing the internal pressure and a 15-inch length of hose fitted with a standard Schrader valve. It is tested for 400 psi. pressure and can be recharged at any filling station. Called the "Ready-Air," it is made by Wales Metal Products Company of Brooklyn, N. Y., and sold by auto-supply stores, garages, and filling stations.

Proper ratio between air and water in pressure tanks of domestic water systems can, it is said, be effected automatically by the use of a new control developed by United States Gauge, a division of American Machine & Metals, Inc. Designated as Type "B" Air Charging Control, it is designed to maintain a constant volumetric relationship between air and water in a storage tank without being affected by the length or frequency of the pump cycle. Air is admitted only when required, and shuts off when there is enough in the tank to operate the system. Moving parts are reduced to a minimum and built of materials that should give years of trouble-free service even when exposed to highly corrosive waters. Unit is suitable for all installations regardless of pump size, well lift, or discharge pressure.

By the use of a furnace assembly developed by Ipsen Industries, Inc., heat-treating and associate operations are performed well-nigh automatically. The equipment includes an alloy conveyor belt that carries the parts to be treated through the hearth, and a 400-gallon quenching tank provided with a wire-mesh belt. With the temperature set at the desired degree and the timer that controls the cycle properly adjusted, the operator depresses a foot valve to open the furnace door, inserts the work delivered on a tray, removes the tray, shuts the door by releasing the valve, and presses a button. From that stage on his attention is not required until the

furnace is reset and he receives a signal for another charge. The alloy conveyor moves its load at a predetermined speed through the heating chamber and dumps it into the quench tank, where the wire-mesh belt traveling along the bottom catches and discharges it into a suitable receptacle. Furnace has a capacity of approximately 200 pounds an hour and is designed for gas or electric firing at a maximum temperature of 1750°F.

According to a recent press report, a Swedish inventor has built a highly sensitive, reversible compressed-air turbine to regulate the quantity of gas in open-hearth furnaces. The unit consists of a wheel, 3 feet in diameter, made up of 24 opposing blades. Disposed on both sides are air jets that are directed against one or the other set of blades, turning the wheel and permitting it to be reversed in a fraction of a second, it is claimed, when making 10,000 rpm.

Improved alloy steels made especially for antifriction bearings, better metallurgical control and surface finishes, as well as more accurate manufacturing equipment and inspection methods are among the factors on which The Timken Roller Bearing Company bases an increase of 25 percent in the load-carrying capacity of its complete line of tapered roller bearings. The results are the outcome of ten years of study, and are verified by performance records in its physical laboratory, where the bearings were continually checked by fatigue-life testing machines, and in the field in all types of automotive, industrial, and railroad equipment. The increase in rating will enable engineers to effect savings in new designs in the cost not only of bearings but also of associate mechanisms. Interested design engineers can obtain detailed information.

Fireproof paneling made of a specially treated cellular cellulose-acetate plastic sandwiched between extremely thin sheets of carbon steel (0.006 inch) has been announced by Du Pont, producer of the core material. The paneling itself is ¼-inch thick and has been developed by the Skydyne Corporation. It is to be sold under the name Pyroply. It is intended primarily for the aircraft industry, but is expected to have a wide field of application where lightness and fire resistance are considerations. The material weighs less than a pound per square foot but is said to be strong enough to support a heavy man, and official tests have proved it to be resistant to applied heat exceeding 2200°F. for more than 30 minutes. Civil Aeronautics Authority specifications require airplane fire walls to withstand applied heat of 2000° for half that period. The hottest cooking oven registers about 550°. Pyroply also insulates against noise.

Industrial Literature

Whiton Machine Company, New London, Conn., will send upon request a copy of an 8-page booklet containing details about its steam turbine of the solid rotor type.

Wisconsin Motor Corporation, Milwaukee 14, Wis., has released a folder describing two new models of the firm's line of 2-cylinder, air-cooled gasoline engines.

Basic characteristics of steam traps and the advantages, special features, and recommended applications of different types are contained in a bulletin issued by the Sarco Company, Inc., Empire State Building, New York 1, N. Y.

A 24-page catalogue describing the applications, welding procedures, and physical properties of gas-welding rods may be obtained from Page Steel & Wire Division, American Chain & Cable Company, Inc., Monessen, Pa.

Dayton Rogers Manufacturing Company, 2835 Twelfth Avenue South, Minneapolis 7, Minn., has available descriptive literature on its overload pitman for hydraulic punch presses. Fitted with an automatic cutout, the pitman is designed to protect the punch-press frame and crank from damage in case the machine is overloaded.

Technical data on the properties, uses, and methods of fabricating stainless steels are contained in a 36-page handbook prepared by Alloy Metal Wire Company, Inc., Prospect Park, Pa. Graphs, charts, and tables have been included to facilitate the selection of the proper stainless steel for each application.

Sibley Machine & Foundry Corporation has prepared a catalogue—No. 67—that lists the features of the firm's new-model drilling machine for general-purpose work in tool rooms and industrial plants. The publication is available in either English or Spanish and may be had by writing to the company at 206 East Tutt Street, South Bend 23, Ind.

Information concerning all types and sizes of bolts, screws, rivets, nuts, and washers is contained in a 90-page catalogue that may be obtained from Clark Brothers Bolt Company, Milldale 1, Conn. Also included are engineering data and tables on such subjects as decimal equivalents, pitch diameters, A. S.M.E. threads, and weights of metal stock in the form of rolled strip, sheets, and bars.

A handbook on the subject of thread-grinding machines will be sent, upon request, by Norton Company, Worcester 6, Mass. Written primarily for machine operators and grinding supervisors, the book describes new developments in the field of thread grinding and also lists operational data submitted by manufacturers of thread-grinding machines. Also available is a handbook on deburring by precision tumbling with alundum abrasive.

Drainers for the removal of large quantities of condensate from evaporators, heaters, separators, coils, or steam lines are described in Form 4340 issued by Cochrane Corporation. Condensate is discharged through the multiple ports of a float-controlled rotary valve, and the rate of withdrawal is determined by the height of the condensate level. Capacities, dimensions, construction data, and prices for all models are listed in the publication, copies of which may be had from the company at Seventeenth Street and Allegheny Avenue, Philadelphia 32, Pa.